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Mines of Penoles Company, Mapimi, Mex.—I

The Ore Occurs in Chimneys and Pipes in Limestone; Some Modern Mining Methods, Including Use of Diamond Drill, Are Employed

BY CLAUDE T. RICE

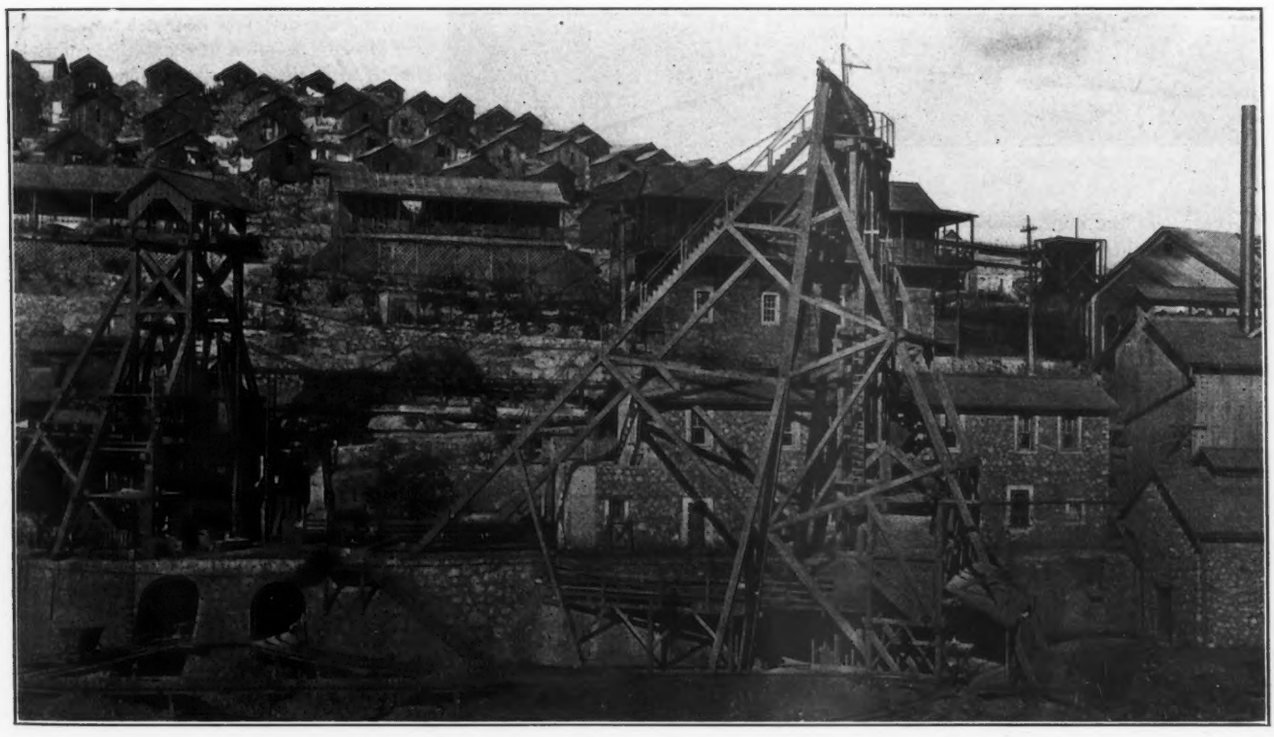
Mapimí is reached from Bermecillo on the Mexican Central, by a narrow-gage railroad, 25 km. long, belonging to the Compañia Minera de Peñoles. The town was founded in 1598 partly on account of the finding of ore near-by and partly on account of the magnificent spring for which the town is famous; in fact, for many years Mapimí was one of the main water places on the *camina real* between Mexico City and Chihuahua, but mining is and always has been the chief reason for its existence.

Spaniards worked the Ojuela and other mines near-by, smelting the oxidized silver-lead ore, in spite of its high arsenic content, in their adobe furnaces. In fact, some stolen ore is still surreptitiously smelted at Mapimí in such furnaces.

The Spaniards operated the mines with great success until 1821 when the Mexicans obtained possession of them. The Mexicans continued the work until 1884, but from 1867 on, the district was almost abandoned until foreigners entered it (about 1890). Two of the foreign companies "went broke" on the Ojuela, but finally in 1893 the Compañia Minera de Peñoles, which had been working a silver mine a few miles farther west, purchased the Ojuela mine. This company also had a hard time following the orebody, which is very irregular, but at last it found rich ore so that now the Compañia Minera de Peñoles is one of the most prosperous companies in Mexico.

valleys on either side and is composed of much contorted, massively stratified limestone. The Bufa has a northwest-southeast trend, and has been the scene of much fracturing, for along both the east and west sides of the mountain extends the wide shear zone in which the orebodies are found. The western part of this zone is still in a prospecting stage, but the central part has been worked for centuries and in it are all the mines at present producing.

All these mines, with the exception of the San Juan, which is producing 80 to 100 tons per day, belong to the Compañia Minera de Peñoles. Consequently, as the Ojuela mine is the largest and best developed of its properties, I will describe it.



PORTION OF SURFACE EQUIPMENT, OJUELA MINE; TIRO NORTE IN FOREGROUND

Mapimí, in fact, is the oldest mining district in Durango, for the Spaniards discovered the mines in 1598, the first ore being found at the Ojuela mine, near the *boca de mina*, the large hole in the side of the *arroyo* under the suspension bridge shown in one of the accompanying illustrations. Here one can see the old steps that the Mexicans cut in the limestone when they first worked the Ojuela, over 300 years ago; this same chimney of ore is still being mined. For years the

The Bufa de Mapimí, of which the ore zone forms part, rises high above the

Novel Feats in Mining Engineering

The Ojuela mine is about six miles south of Mapimí, high up on the eastern side of the Bufa de Mapimí. While the Ojuela mine is below the line of cliffs that are so prominent nearer the top of

the Bufa, still the side of the mountain near the mine has been cut up so much by deep gulches that the surface equipment had to be erected in a sag of the ridge containing the orebodies, necessitating expensive construction and some novel features in mining engineering.

The mine is connected with the company's smelter at Mapimí, by a 30-in. railroad. The first four miles of this road are level, but between El Cambio, at the base of the mountain, and Ojuela, there is a rise of 1100 ft. in two miles. This necessitated the building of a rack road, for the average grade is over 10 per cent.; however, near the mine, owing to the irregularity of the country, the grade is 14 per cent., while for a considerable distance the grade is 12 per cent. to make up for the 7-per cent. grade near the base of the mountain. The ore is hauled to the smelter in trains of four cars, holding eight tons each, and on the return trip supplies are taken to the mine. In fact, it is this rack road which has made possible the installation of the large machinery, necessary at the mine, without sectionalizing it.

SORTING OXIDIZED ORE, OJUELA MINE

Owing to the deep *arroyo* between the Socavon and the Ojuela shafts, a suspension bridge was necessary to connect the Socavon shaft with the rack road. This suspension bridge is 1100 ft. long and, at its center, 300 ft. above the bottom of the *arroyo*. It was built by the John A. Roebling Company, of Trenton, N. J., in 1899, and was at that time the second longest suspension bridge in the world. As this suspension bridge has a heavy grade from the Socavon end toward the Ojuela end, the ore trains consisting of four cars each are handled on the bridge by means of an 18-h.p. hoisting engine.

Such are some of the novel features above ground, and yet underground there is another suspension bridge, 60 ft. long, which was necessary to bridge an old stope so as to prospect the ground on the other side. This suspension bridge was cheaply constructed from old hoisting cable, anchored to eyebolts, wedged into holes, drilled into the strong limestone forming the walls of the stope. To these main cables, 6x8-in. cross pieces were fastened by small pieces of steel cable, and on these cross pieces the stringers that carry the rails were placed.

The Ore Occurrence

The ore, which is an arsenical silver-lead ore, occurs in a vertical shear zone, 3000 ft. wide, running northwest and southeast through the limestone. A diorite dike occurs near the east boundary, and there is also another near the west boundary, but the shear zone extends beyond these dikes, and ore has been found at some distance to the east of the east dike. Through the shear zone cuts a strong fault called the San Diego fault; this is almost vertical, and has caused considerable displacement of the strata, for to the west the limestone has only a slight dip, while to the east it is highly inclined. This fault was formed prior to the formation of the orebodies and apparently it has had some influence on their location.

As is characteristic of limestone districts, the ore occurs in irregular bodies, many of which outcrop at surface. The orebodies appear to have a tendency to form along northwest-southeast fractures and the pitch is commonly toward the northwest. The orebodies are chimneys, not veins, which suddenly change both in their dip and in their strike. Indeed, in some places the orebodies change their course so suddenly (almost 90 deg.) as to indicate the existence of secondary jointings in the limestone at right angles to the main direction of shearing. In some places the orebodies form large chimneys, in others, small pipes; they either follow or cut across the bedding planes. The irregularity of these deposits is well shown by the Ojuela orebody, one of the largest in the mine.

The Ojuela and San Carlos Orebodies

Down to 25 m. the Ojuela orebody, which is best described as a large chimney, has a pitch of 20 deg. at first N. 30 deg. W., then almost due west; but at 25 m. the chimney becomes almost vertical with a pitch toward the southeast until at a depth of 100 m. the pitch turns N. 15 deg. W., the chimney remaining almost vertical to a depth of 150 m. At that depth the pitch flattens to 45 deg. and is toward the northwest until the depth of 175 m. is reached, where it becomes vertical. At a depth of 250 m. the orebody splits, inclosing a lens of limestone, 30 m. wide. The two parts come together again at 350 m., and continue vertical to a depth of 500 m. At that point the pitch changes to 40 deg. toward the southwest, but at a depth of 550 m. the pitch turns to almost due west, the angle remaining the same, until at a depth of 600 m. the pitch flattens to 15 deg., and is due north. At a depth of 610 m., the

SORTING SULPHIDE ORE, OJUELA MINE

pitch changes to N. 70 deg. W., the angle remaining the same until at 620 m. the chimney again becomes vertical and continues so to a depth of 700 m.

An irregularity fully as pronounced is also characteristic of the other large chimneys, such as the San Pedro, the Paloma, and the Santo Domingo orebodies. In the San Carlos orebody, which is composed of several related occurrences, the ore forms in small pipes, from 3 to 8 ft. in size, which have already been developed for a distance of 600 ft.; throughout this distance the small, but irregular, size remains remarkably characteristic of these pipes. In places these pipes, like the larger bodies, cut across the bedding planes, or they may follow the bedding planes, in which case they are approximately parallel either to the strike or to the dip of the limestone. These pipes have a tendency to occur in parallel groups, sometimes entirely separate from one another, but often connected in many places with small pillars of limestone between them. When the pipe is approximately parallel to the strike of the strata, it has a slight pitch toward the northwest.

As has been said, the ore in the Ojuela mine, and also throughout the district, occurs in many different forms, the common characteristics being the irregularity of the pitch and the prevalence of washed walls and water courses in the oxidized, and only the oxidized, portion of the orebodies, indicating the presence of strong circulating currents during the period of oxidation.

The zone of oxidation is very deep for the change from the oxidized to the sulphide ore does not take place until between the 12th and 13th levels, at a depth of 1700 ft. At this point of change the ore shows secondary enrichment in some places, but at other places there is no sign of such enrichment.

In the upper levels the oxidized ore consists mainly of silver-bearing carbonate in a calcareous gangue heavily stained with iron oxide. This oxidized ore carries 400 grams silver and 4 grams gold per metric ton, 13 to 14 per cent. lead, and 9 per cent. arsenic. The sulphide ore consists mainly of argentiferous galena associated with some sphalerite and considerable arsenopyrite. The sulphide ore assays 500 grams silver and 4 grams gold per metric ton, 11 per cent. zinc, 12 per cent. lead, and 9 per cent. arsenic.

Method of Hoisting

The mine is worked through several vertical shafts, which are close together owing to the fact that some of them were necessary because in depth the former shafts had passed into the orebody. The last, the Tiro Norte, the only one having two compartments, has been sunk to a depth of 2624 ft. to serve as a main working shaft, for it was better to sink this shaft than to tie up the mine while enlarging one of the other shafts. In fact, the hoisting system is not in its final stage, for the main shaft, although 2624 ft. deep, is not used at present below the 1700-ft. level, owing to the fact that as yet it has not been connected with the main orebodies on the lower levels. Consequently several single compartment "counter-shafts" are used for hoisting the ore from those levels up to the 1700-ft. level. These shafts are equipped with drum hoists run by 150-h.p. induction motors, the sheave wheels and the drum being connected by an inclined raise.

Above the 1700-ft. level several shafts are used for hoisting owing to the exigencies of lowering and hoisting, on company time, 1200 men each day. In fact, since in Mexico at least two and a half times as many men are required underground per ton of ore hoisted as in the United States, the hoisting and lowering of the men is an important problem at the large, deep mines.

TRIANGULAR CROSSHEAD USED WITH ROPE GUIDES, OJUELA MINE

The levels from these shafts have been driven at irregular intervals above the 450-m. level, but below that level the interval, 50 m., is regular down to the deepest, the 800-m. level. On the 216-m. level an adit connection has been made with surface so that, with the exception of that for the boilers, no water has to be pumped above the 216-m. level.

The main hoisting shaft is timbered with regularly framed 8x8-in. shaft sets, placed at 5-ft. centers, but posts have been placed in the middle of the end plates and dividers so as to strengthen the guides and to permit splicing at any place along their length. All the other shafts are untimbered, except for an occasional stull placed to hold the air pipe and pump-column, for the limestone is strong and does not air-slack. In fact, the main shaft was timbered not on account of weak ground, but merely so as to hold the guides, for the limestone was so hard that it was cheaper to use shaft sets than to cut hitches and put in stulls to carry the guides.

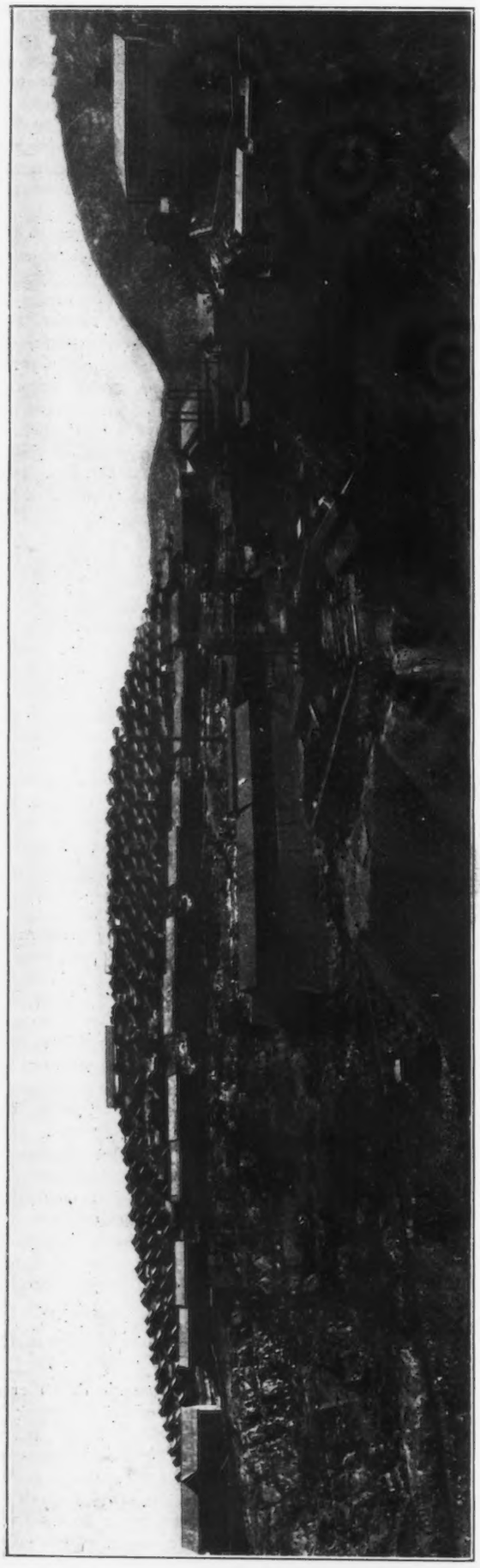
In the main shaft the hoisting is done with reel hoists, 3½x⅜-in. flat cable and self-dumping skips being used. This the Mexicans re-sew so well that their work compares favorably with similar work done in the States. In the untimbered shafts, which have only one compartment, buckets and wire-rope guides are used. These guides are made of four-strand, ⅝-in. wire rope, fastened to eye-bolts in the bottom of the shaft, or, when sinking is being done, fastened to wire ropes stretched between eye-bolts placed in drill holes in the sides of the shaft. The wire-rope guides pass over pulleys in the head-frame and then down to a hand winch by which they are tightened. The bucket, having a capacity of one ton, is hung from a triangular crosshead, made by bolting together two triangular frames of 3x5-in. timber, the angles being strengthened by means of iron plates. The bucket is made with a long bale attached to pins placed below the center of gravity and is kept from dumping by means of links passing over lugs in the top of the bucket. The wire-rope guides pass through babbitted boxes bolted onto the end of the triangle which, of course, is placed with its apex up. Spinning of the bucket is prevented by lashing the ring of the bucket chain to the crosshead.

The buckets run with remarkable smoothness on the guides and probably there is not more than 5 to 6 in. vibration in the center of a guide 1700 ft. long, even during rapid hoisting. With these rope guides hoisting is rapid for I have seen an ordinary trip and return, including the dumping on top and the fastening of the loaded bucket at the bottom, made from the 1700-ft. level in two minutes.

In using this system, provided they are kept tight by means of the winch, the guide ropes work satisfactorily, and surely it is cheaper to put in rope guides than to timber a shaft if buckets are to be used; but, if cages are to be used, the rope guides are not steady enough for fast hoisting.

The Mexican Method of Mining in the Smaller Stopes

The method of stoping in the different orebodies varies considerably owing to differing characteristics in each. In the large bodies regular overhand stoping or underhand stoping is used, but in the irregular orebodies Mexican methods of mining are employed, for it does not pay to drive drifts or crosscuts to get under



THE OJUELA MINE SHOWING THE MEXICAN TOWN ON THE SUMMIT OF THE RIDGE AND RACK ROADS AT BASE OF THE CLIFF

THE SUSPENSION BRIDGE LEADING FROM THE SOCAVON SHAFT TO THE OJUELA SHAFT. THE BLACK SPOT IS WHERE THE OJUELA OREBODY COMES TO SURFACE

small orebodies. The Mexican methods were devised during centuries spent in working the irregular deposits in limestone, so characteristic of northern Mexico, or else in following narrow streaks of rich ore in large veins. Consequently, for cheaply working small irregular deposits, provided labor is not expensive, the Mexican method of following the ore and packing it out on the back is hard to improve upon; but, of course, it is not economical in large orebodies, even when the labor is cheap and accustomed to the methods.

The Mexican miner will follow the ore with narrow workings, taking out only the minimum amount of ground when the pay streak is narrow; indeed, he will work in narrow, winding places where an American miner would not work for an instant, and in spite of the necessarily poor ventilation will do a good day's work. From such places the *peon* packs out on his back, the load, weighing between 80 and 100 lb., which he has scooped into a sack by means of a horn or iron scraper, for it is impossible to use a shovel in such workings.

It is on account of the gophering character of much of the early work, which was necessary in order to obtain the rich ore required by the crude metallurgical methods, that the Mexican has developed so many oddities in his mining, such as a desire for a short-handled double jack, and especially an aversion to the shovel, which in some parts of Mexico he is reluctant to overcome. Consequently, in the Mexican prefers even in wide places to use a long-handled hoe to fill a small pan, held between his feet, and then to dump the filled pan into the car, rather than to shovel the ore directly into the car. The speed with which he will fill a car in this manner is remarkable, and in a drift the Mexicans are often seen filling two cars at the same time, on the same track, the ore being packed in pans. Frequently on a Fourth of July the Americans put up prizes for a car-loading contest, and it is said that with several *peones* in the contest, each busy with a hoe and pan, such a contest becomes almost as exciting as a double-hand drilling contest.

As the Mexican at Mapimí appears to be able to fill a car as quickly with a pan as with a shovel, and as he is more contented using his own method than the methods of the *gringos*, much of the ore at the mines of the Peñoles company is loaded into cars by the hoe-and-pan method.

A modified form of the chicken ladder is also used at the Ojuela mine. These are made by nailing cleats, 4 in. thick, onto a 2-in. plank, 8 in. wide. These ladders are light and cheap and, as the Mexicans prefer the chicken ladder to regular ladders, it is in many cases policy to use chicken ladders. Indeed, the common type of the much scorned chicken ladder, made by notching either a round pole, 10 or 12 in. diam., or a 6x8-in. timber, is far preferable to an ordinary ladder in an untimbered raise where the rock must be blasted onto the ladders, for it is hard to break a chicken ladder.

These Mexican methods have been described so that the engineer unfamiliar with Mexico will appreciate the fact that these apparently crude methods devised by the early Mexican miners are well adapted not only to mining small irregular deposits but also for developing the orebodies until they increase sufficiently in size to warrant more expensive methods of development; and so that he will realize that good engineers use such methods in Mexico when circumstances warrant their use.

Overhand and Underhand Stoping in the Larger Orebodies

When the orebodies are large, either overhand or underhand stoping is used; in either case a drift is driven to cut the orebody and raises are put up or winzes sunk from the level above to serve for ventilation and as ore chutes. But in general the underhand method is used, for with it no timbering is required as the walls are strong and do not air-slack. The ore is all mined on the way down and the limestone walls are cleaned of any slabby ground; consequently large stopes can be worked without accident. When the orebody is flat frequently overhand stoping is used, since then no staging is required.

In some of the wide orebodies much ore, formerly too poor to mine, has been left on the walls. In the past this ore was mined by erecting scaffolds along the sides of the stope, from which the miners drilled, but now waste filling is used and chutes are carried up with the filling as the overhand stripping of the walls proceeds. The ore in the stopes is soft and consequently the ore is drilled by hand. The drifts and crosscuts are also driven by hand except that, when speed is desired, machines are used. These drifts and crosscuts are all 2x2 m. in size in order to allow the setting up of diamond drills crossways in them for prospecting the ground to either side. Two 2¼-in. machines, mounted on a cross bar, are used in driving. All mining, drifting and crosscutting is done on contract. The price paid for a 2x2-m. crosscut is 45 pesos per meter; the Mexicans furnish all labor and supplies and deliver the broken rock at the shaft. Frequently with two 2¼-in. machines in the breast these Mexicans will drive, two shifts being worked per day, 50 m. per month in the limestone.

The price paid for mining and delivering the ore to the shaft varies considerably with the nature of the orebody and its distance from the shaft. In large orebodies often only 90 centavos per ton is paid, but in the smaller orebodies, where the ore has to be packed on the back, as much as 3 pesos per ton is paid; the average throughout the mine is about 2 pesos per ton. At these prices the miners make from 2 to 3 pesos per day and that is the scale at which miners on day's pay are paid. The Mexican contractors pay their machinemen 4 pesos per day.

Prospecting with Diamond Drills

Owing to the irregularity of the orebodies the prospecting is done by means of diamond drilling from the different drifts and crosscuts. At present between 5500 and 6000 m. of holes are drilled per month by the 15 diamond drills, four of which are Sullivan type "R" drills and the rest of Swedish make. These latter were originally operated by hand power, but the company has converted them into power drills by adding two friction wheels and a direct-current motor to drive the drills. Most of these Swedish drills are at present fed by hand, but A. Frey, the engineer in charge of the diamond drilling, is perfecting an automatic feed which is doing very good work.

LOCAL NO. LOCATION
MACHINE NO. MAGNETIC BEARING VERT. ANGLE

Date	Shift	Progress	Total Length	Hours Run	ORE Dist.	ORE Thick	ASSAYS Au	ASSAYS Ag	ASSAYS Pb	REMARKS

INDEX CARD FOR FILING RECORD OF DIAMOND DRILL HOLES

The pumping for the Swedish drills has to be done by means of a hand pump, but this is no disadvantage when using Mexicans on diamond drills, for the man doing the pumping immediately detects any clogging of the drill and warns the operator before the bit is damaged. For this reason the wear on the diamonds is not so great with the Swedish as with the Sullivan drills.

Formerly a system of squares, 120 m. on a side, was used in blocking out a level for prospecting with diamond drills, but now this method has been abandoned, because it is more expensive than the new method now used, and because it had not been the means of discovering any orebodies which would not have been found by the cheaper method.

In the new method the drifts and crosscuts are not laid out systematically, but are driven to develop known orebodies or to follow the San Diego fault and other fractures. The general direction of the

drifts is taken as a base line from which to set up the drills; the position of each set-up is determined by means of a transit and the direction of the hole is marked so that the drill holes will be parallel and at 5-m. centers. The diamond drills are set up by means of plumb bobs hung from the marked stations so as to assure accuracy of alinement and position, the rod is leveled, and holes 60 m. deep are drilled in both directions from each set-up.

The distance drilled each shift, the distance at which any dike or any orebody is cut, the width and the value of the ore (as determined from sludge samples, for little core is obtained when drilling in ore), together with the direction and position of the hole, are kept on cards which are filed in a card index (see accompanying cut). From this data the drill holes are plotted on special maps reserved entirely for diamond-drill work and on which only the principal workings are indicated so as to permit orientation.

The cores, which vary between ¾ and 5/16 in. diameter, are not kept, as the limestone is all of the same general character. Practically all holes are drilled horizontally and parallel to the others drilled from the same drift, but at the end of a drift the holes are drilled in different directions with an angle of 10 to 20 deg. between them so that they form a horizontal fan 60 m. in radius, prospecting the country beyond.

The footage drilled per shift varies considerably from day to day and also with the machine used. The drills equipped with the Frey automatic feed drills an average of 13 m. per shift; the Sullivan type "R" machine drills 10 m., while the hand-fed Swedish machines average between 6 and 7 m. The drilling is done on contract for 40 centavos per meter. This makes the cost of drilling about 1.35 pesos per meter including the cost of labor, power, diamond loss, repairs, and superintendence. All diamond-drill men are Mexicans, except the engineer in charge and the diamond setter.

Pumping, Production and Power

All the pumping is done by electric pumps, most of which are run by induction motors, but a few direct-current pumps are still in use. The station pumps of Jeanesville type have a capacity of 400 gal. per minute, and are run by 150-h.p. induction motors; two of these are pumping from the 500-m. to the 217-m. level and two from the 800-m. to the 500-m. level. On the 215-m. level the water flows to surface through an adit connection. In order to lower these heavy pumps a worm-driven Denver Engineering Works heavy-duty machinery hoist was used, which did the work admirably. A Sulzer centrifugal pump having a capacity of 700 gal. per minute against a head of 1000 ft. has been ordered and will be installed as soon as it arrives. On the 217-m. level small electric-driven triplex pumps are installed to pump the boiler water, and the water used for washing, etc., to the surface.

At surface the large sizes of the low-grade oxidized ore is sledged and hand-picked, while all the sulphide ore which will not pass through a 2-in. opening is closely hand-picked. But as the company owns its own smelter, which is near-by, this sorting is not extensive.

At present the mine is producing 500 tons of ore per day, about 100 tons of which is sulphide ore, and approximately 1200 men work underground. At the mine all employees except superintendent, assistant master mechanic, electrician, head diamond setter, master mechanic and assistant master mechanic, electrician, head pumpman, head carpenter, foremen and cashier, are Mexicans.

All electric power is generated at the smelter and transmitted at 6600 volts (alternating) to the mine where it is transformed to 440 volts for use in driving the underground pumps and motors. Some of the current is changed by a motor-generator set to direct-current at 250 volts for use in electric lighting and for running direct-current hoists, pumps and diamond drills. The mine is equipped with two electric-driven Ingersoll-Rand compressors having 2000 cu.ft. per minute capacity. At the mine only sufficient steam is generated to run the surface hoists, for all other machinery is run by electric power.

New Apparatus for Electrolytic Determination of Metals

F. C. Frary (*Journ.* Amer. Chem. Soc., XXIX, pp. 1592-1596) describes two forms of apparatus for the rapid determination of metals by electrolysis without the use of rotating electrodes.

The first form of apparatus consists of a solenoid of about 500 turns of 1.5 mm. Brown & Sharpe No. 14 insulated copper wire, wound on a copper cylinder, 6 cm. in diameter and 11 cm. high, flanged at either end with sheet iron. Within the copper cylinder at its lower end is a hollow iron cylinder, 4 cm. high. The solenoid is surrounded and protected by an iron mantle, 2 mm. thick, which presents a short path for the magnetic circuit on the outside of the coil. This arrangement concentrates the entire magnetic force of the solenoid in that portion of its core above the inner iron cylinder.

The beaker used in the analysis is set within the solenoid, supported by the inner iron cylinder and should have a capacity of from 125 to 150 c.c. The cathode may be of platinum foil, or platinum, copper, silver or nickel gauze, and should fit the beaker rather closely, while the anode may be a plain spiral.

The solenoid and the electrolytic cell are usually connected in series. The resistance of the coil is about one ohm, and a current of 5 amperes may be employed for a long time without danger of overheating; indeed, the heat imparted to the electrolyte is often an advantage. In case the heating of the electrolyte is a disadvantage, a smaller beaker may be used and jacketed with a coil of lead pipe through which water flows. If a higher current is wanted, it is a simple matter to arrange separate circuits for the solenoid and the electrolytic cell.

When the apparatus is in use, the lines of force pass down through the electrolyte cutting the lines of electrical current passing from the anode to the cathode. Every infinitesimal strip of electrolyte between the electrodes acts as if it were a wire carrying a current, and being cut at right angles by the lines of force immediately moves in a direction perpendicular to the lines of force. In this manner a circulation of the electrolyte within the beaker is set up, the speed of rotation of which is governed by the strength of the current in the solenoid and that passing through the cell.

The Apparatus with Mercury Cathode

The second form of apparatus was devised for use with a mercury cathode where the current lines are vertical. The beaker for this form has its bottom projected upward so that in cross section it has the form of a ring. The beaker is made of Jena glass and has three platinum points fused in the bottom, projecting into the mercury within. It rests upon, and forms contact with, an insulated copper plate on top of the solenoid, and is connected with the source of current. Projecting up within the space in the bottom of the beaker is an iron pole from the solenoid, while the pole from the other end of the solenoid is brought up to form a ring around the outside of the beaker. The lines of magnetic force are thus concentrated in this ring-shaped section of the beaker and being at right angles to the direction of the current, circulation is established. The beaker is 5 cm. in diameter and 10 cm. high and has a capacity of 200 c.c., which gives sufficient room for any boiling or frothing that may take place. The solenoid coil has 500 turns of No. 16 Brown & Sharpe insulated copper wire wound on an iron core 1.6 cm. in diameter. With a current of 3.4 amperes, and with the solenoid and cell connected in series, the speed of rotation of the electrolyte was about 100 r.p.m.

These forms of apparatus seem especially excellent, for they offer a means of rapid electrolytic analysis that is free from the objections to apparatus where rotation of the electrolyte is obtained by mechanical means.

A reduction of oxygen in air from 20.93 per cent. (the normal amount) to 17 per cent. will extinguish lights, but for a short time will not affect men appreciably.

The Cost of Silver-Lead Smelting

A Study of the American Smelting and Refining Company, Which Is Estimated to Have Made a Profit of $2 per Ton of Ore Smelted

BY WALTER RENTON INGALLS

The relation between miners and smelters, in so far as concerns the purchase by the latter of the ores produced by the former, is a matter of general and absorbing interest. The conditions under which silver-lead ore is smelted have been described and discussed elaborately in several standard treatises, and in many articles in the industrial periodicals, but either because these analyses are too technical or because of inability to deduce generalizations from a mass of data pertaining to various particulars, there is a general demand for information as to the cost of smelting silver-lead ore in the United States; the cost of refining the base bullion; the percentages of silver and lead extracted; and finally, the first cost of the plant. In the absence of such information, it is a common belief that the smelters charge more for the treatment of ore than they ought to; in other words, that they make a greater profit out of the miners than is fair to the latter. The present article is an attempt to deduce from the official reports of the American Smelting and Refining Company, by all means the most important smelter of silver-lead ore in the United States, some general conclusions as to its treatment of the mining industry; and also as to its own standing as one of the great industrial enterprises of the United States in which many thousands of persons are interested as stockholders. Two other parties of interest are the management which conducts the affairs of the company and the consumers of metals, particularly lead, who purchase their supplies from it. The most important portions of this article are derived from the official reports of the American Smelting and Refining Company and the United States Smelting, Refining and Mining Company, which are public property and open to the analysis of anyone who cares to undertake it. The technical data incorporated in the article are well known to members of the profession who are engaged in the smelting industry.

The Average Cost of Smelting

No data respecting the average cost of smelting and refining in the United States have ever been published, and it would be next to impossible to obtain it. The costs range rather widely among the various plants, depending upon the size and nature of the plant; the cost of labor, fuel, fluxes, and material; the character of the ores smelted, etc. Thus, nine plants during the same period of six months, a few years ago, showed costs of smelting, referring to the blast-furnace operation only, per ton of charge (ore and flux) which ranged from $2.50 to $4.80. This appears in the following table:

COST PER TON OF CHARGE
(Ore and Flux)

Works.	Amount.	Works	Amount.
A	$3.418	F	$3.429
B	2.525	G	3.929
C	3.260	H	4.039
D	3.331	I	4.781
E	3.754		
		Average.....	$3.607

Consequently, it must be borne in mind that what I shall go on to say is simply in the nature of broad generalization, and does not apply to any specific case. For the same reason allowances must be made for what may appear to be inaccuracies by comparison with specific cases.

In the treatment of the argentiferous ores of the West, different conditions enter into the consideration. In the working of those ores, the present practice is to roast only those which are low in lead, and charge raw into the blast furnace the rich galena. The cost of roasting is about $2 to $2.50 per ton of ore roasted. The cost of smelting a ton of charge in a large modern plant, under favorable conditions, is about $2.50, of which about 84c. is for coke and $1.66 for labor, power and supplies. The expense of administration amounts to about 16c. additional. Consequently, the total cost per ton of charge (ore and flux) is about $2.66. If the ore amounts to 80 per cent. of the charge, which corresponds to the ordinarily good practice, the cost per ton of ore is about $3.33.

In the case of a sulphide ore something more has to be added for the roasting, whether the latter be done in a special furnace, or in the blast furnace. If the galena be charged raw into the blast furnace, a certain portion of its sulphur is burned off, but another portion reappears in the form of matte, which must be roasted in a special furnace. Smelters reckon roughly that it costs about 25c. per unit to get rid of sulphur in whatever way that be done. An average of the work of many large smelting plants shows that for every ton of charge smelted in the blast furnace, about 0.4 ton of material (ore and matte) must be roasted. The cost of roasting ranges from $2 to $2.50 per ton. Taking the lower figure, in view of economies which have been effected by the blast-roasting process, we may figure that on the average 80c. is to be added to the cost of smelting, making the total cost per ton of ore about $4.12. Figuring on the same basis of 80 per cent. of ore in the charge, the average for the nine works previously mentioned would be $3.607 ÷ 0.80 = $4.50, approximately. I shall adopt the latter figure.

Interest Charges, Amortization, Etc.

However, there are other things which enter into the reckoning of the smelter. His works, capable of smelting 1000 tons of ore per day, or roughly 330,000 tons per annum, have cost in round figures nearly $1,000,000, or about $3 per ton of annual capacity. Reckoning amortization at 10 per cent. per annum, and interest on the investment at 6 per cent., the smelter must add 48c. per ton of ore smelted on account of these fixed charges. Moreover, the smelter is bound to carry a large stock of ore on hand, upward of a month's supply being required for ordinary safety and the necessity of making up beds of the proper mixture. Assuming that the works which is treating 330,000 tons of ore per annum has always 30,000 tons on hand, and that the average value of the ore is $30 per ton, the interest charge on each ton of ore smelted is upward of 15c. A month's delay in realizing on the products adds 15c. more.[1] This makes a total of $5.28 up to this point, namely, the production of base bullion. The smelter has recovered about 95 per cent. of the lead and 97 per cent. of the silver in the original ore. He has paid the miner for only 90 per cent. of the lead and 95 per cent. of the silver, wherefore he has a certain leeway on these metals, as he may have also on gold for which he has paid the miner only 95 per cent., but recovers 100 per cent.[2] Also he obtains an advantage from a few by-

[1] It will appear subsequently that this estimate of the time that ore and crude metal are in process of treatment is under, rather than over, the average. As a matter of fact smelters roughly figure interest on the basis of 90 days.

[2] The actual extraction of lead is less than 95 per cent., but in good practice it is 95 per cent. on the basis of fire assay, on which much of the ore is purchased, so it is proper to figure 95 per cent. However, this is drawing it rather tightly upon the smelter, and considering the further loss of 1 per cent., which the lead suffers in refining the smelter who pays for 90 per cent. of the lead in the ore does not obtain any great margin on this item, nor does he on the purchase of the silver. The smelter does not really recover 100 per cent. of the gold, although he may apparently do so, and even more, because of the cumulative effect of small amounts of gold, too little to figure in the ore settlements, which give the smelter more to start with than his books show.

products, which do not amount to much per ton of ore, but are considerable in the aggregate.

Copper

Besides the gold, silver and lead of the ore there is a certain amount of copper, modern practice demanding the presence of 0.5 to 1 per cent. in the charge in order to insure a clean slag. This copper goes partly into the slag, and partly into the base bullion (from which it is recovered during the refining process), but chiefly it is obtained in the form of matte, which is concentrated up to about 40 per cent. copper and then is despatched to Omaha, where it is converted to blister copper. The converting of this leady matte is more costly than the treatment of ordinary copper matte, and indeed throughout the lead smelting process copper is subject to high losses, especially in the slag of the first smelting, which follows from the common metallurgical principle that losses are quantitatively constant (or nearly so) and proportionately variable. Consequently in the treatment of an ore so low in copper as 0.5 to 1 per cent. the percentage of loss is large. It may be generalized, perhaps, as 30 per cent. It is for this reason that the smelter makes so large a deduction from the copper in the ore (1.3 units off from the wet assay) and pays for it at 3@7c. less than the price of refined copper at New York. Of course the reader will understand that the deduction of 1.3 units pertains to ores that contain sufficient copper to deserve payment, and that those ores when mixed with many others that contain no copper give an average furnace charge with 0.5 to 1 per cent. copper. It may be explained also that all of the copper does not finally appear as refined metal, a fairly large quantity being obtained and marketed as bluestone. However, in the generalization which I am attempting it is impossible to go far into these details.

Freight and Refining

The products of the smelteries are base bullion and lead-copper matte. The latter goes to Omaha for converting and the blister copper thence is passed on to Perth Amboy for refining. The base bullion goes to Denver, Omaha, Chicago and Perth Amboy. As in the case of smelting there are differences among these works as to the cost of refining and other conditions, but inasmuch as the prices for lead and copper are based on the market at New York it is best to confine attention to the refining and handling of base bullion at that center.

The freight rate on base bullion from Salt Lake City to New York is $10.80 per ton; from Denver and Pueblo to New York it is $6.40 per ton. The cost of refining is $6@$6.50.[1] Other costs are lighterage, $0.625; selling, $0.40; miscellaneous, $0.325. This gives a total of $7.60 exclusive of freight. The cost of a lead refinery is about $6.66 per ton of annual capacity, on which amortization at 10 per cent. and interest at 6 per cent. come to $1.07, making the total cost of refining, lighterage, selling, etc., about $8.67. Consequently the charges on a ton of ore smelted at Salt Lake and yielding 10 per cent. of lead are as follows:

Smelting	$5.28
Freight on bullion	1.08
Refining, etc.	0.87
Total	$7.23

In addition to the above total, $7.23, the reports of the American Smelting and Refining Company indicate a general expense amounting to 25@40c. per ton of ore smelted, the smaller figure being achieved in the more recent years. Consequently we may put the total cost of smelting and refining at about $7.50 per ton of ore.

In custom-refining it is the practice to pay the smelter, i. e., the seller of the base bullion, for the gold at $20 per oz.; for the silver at the New York price less 1c. per oz. (this is 98 per cent. when silver is worth 50c. per oz.); and for the lead at 98 per cent. of the New York price. The actual extraction of lead is 99 per cent. The loss of silver is so small that it may be disregarded for present purposes.

Neglecting the freight and refining charges on copper, and some minor incidentals, it may be assumed that the total cost of smelting a ton of average ore is about $7.50; that the extraction of gold is 100 per cent.; of silver 97 per cent.; and of lead, $0.95 \times 0.99 = 0.94$ per cent.

The American Smelting and Refining Company

The reports of the American Smelting and Refining Company throw but little light upon the subject of the cost of smelting. Its statement of assets, gross earnings, profits, etc., for a series of six years, is given in the accompanying tables. Before proceeding to discuss these figures, it is important to make certain explanations. In each year the figures are for the fiscal period ending April 30, wherefore the major part of the period pertains to the preceding calendar year. The item that I have entered as "Repairs" is given in the reports of the company as "Ordinary Repairs and Betterments." What I have called "General Expense" includes all of the general expenses of administration, together with interest and taxes. "Net Earnings," so called by the company, are evidently not properly designated, being merely the operating profit. The true profit, or actual net earnings, appears later in what the company calls "Net Income." Under "Improvements" I have entered what the company calls "Appropriation for Extraordinary Improvements and New Construction." From the uniformity of this account, I judge that it represents chiefly the new construction undertaken to replace worn out or antiquated plant; in other words, it is in this way that the company makes good the depreciation of its property, which otherwise would have to appear in an amortization account. Thus the plant at El Paso has been practically rebuilt, and extraordinarily extensive improvements and additions have been made at Leadville, Omaha, Perth Amboy and other works during recent years. In Utah the Murray smelter, an entirely new plant, has been built. Obviously the actual net earnings do not appear until after all of these charges

I. A. S. AND R. CO. COMPARATIVE STATEMENT OF ASSETS.

Year.	1903	1904	1905	1906	1907
Property account	$86,845,671	$86,845,671	$86,845,671	$86,845,671	$86,845,671
Investment account	1,028,598	1,680,306	*3,982,576	*4,179,915	*3,810,595
Metal stock (Au. Ag. Pb. Cu.)	18,010,687	17,032,300	16,418,543	19,415,200	18,251,587
Material, fuel, flux	1,107,253	1,224,688	1,118,902	1,114,893	1,317,544
Cash	2,339,154	4,047,423	4,636,649	4,757,929	6,706,984
Total assets	$109,331,362	$110,830,387	$113,002,340	$116,313,607	$116,932,381

*Does not include 177,510 shares of the common stock, American Smelters Securities Company, par value $17,751,000.

II. A. S. AND R. CO. COMPARATIVE STATEMENT OF INCOME ACCOUNT.

Year.	1902	1903	1904	1905	1906	1907
1. Earnings	$7,038,682	$9,403,711	$9,425,443	$10,506,683	$11,665,886	$13,250,058
2. Repairs	791,306	770,854	818,141	878,648	828,582	976,535
3. General expense	1,385,757	1,056,786	701,729	729,224	675,945	763,854
4. Net earnings	4,861,619	7,576,786	7,905,573	8,898,811	10,161,358	11,509,669
Employees' fund	.....	.....	91,254	216,816	449,204	540,420
6. Improvements.	1,300,000	655,683	597,582	425,289	938,100	1,054,996
7. Metal account.		1,500,000	500,000	637,795	Nil.	Nil.
8. Net income	3,561,619	5,421,103	6,716,737	7,618,912	8,774,055	9,914,253
9. Dividends	3,500,000	3,500,000	4,750,000	6,000,000	6,750,000	7,000,000
10. Surplus for year	61,619	1,921,103	1,966,737	1,618,912	2,024,055	2,914,253
11. Total surplus.	2,951,968	4,873,071	6,839,808	8,458,720	10,482,775	13,397,028

[1] At Chicago the cost is only $4 and under favorable conditions lead refining should be done at that figure.

have been deducted. As to the sufficiency of the allowance for amortization made in this way I shall have something to say further on.

At no time has the Smelting Company made any statement of its production of metals or amount of ore smelted. The nearest that it has come to communicating this important information was in the report for the fiscal year ended April 30, 1903, wherein it is stated that the volume of business transacted during the year is reflected in the following figures: Metal content of ore purchased: gold, 1,025,132 oz.; silver, 62,389,438 oz.; lead, 492,960,350 lb.; copper, 47,919,666 lb. Fuel consumption: coal, 544,790 tons; coke, 433,431 tons; fuel oil, 3,523,904 gal. Freight traffic: total tonnage moved, 4,434,484.

Tonnage of Ore Smelted

These data enable us to arrive approximately at the amount of ore purchased, and we may assume that the amount smelted was approximately the same. It is a fair assumption that the ores were purchased in substantially the proportions required to make a suitable smelting mixture, and that the lead content was in the neighborhood of 10 per cent. of the total ore. The purchase of 246,480 tons of lead would therefore imply 2,464,800 tons of ore. Some of the copper purchased was included with the lead charge, but some was smelted separately. As to this particular I can do no more than surmise that 100,000 tons of copper ore may have been smelted separately, and that the total amount of ore smelted by the company in this year was about 2,564,800 tons. It will appear that this estimate is probably not far out of the way. In 1901 the American plants of the company alone were smelting at the rate of about 2,000,000 tons of ore per annum, and from that time onward business increased. In the fiscal year ending April 30, 1903, the total movement of freight is given as 4,434,484 tons. Deducting 991,221 tons for fuel (allowing 13,000 tons for the oil) and 270,439 tons of lead and copper, we have left 3,172,824 tons for ore and limestone, of which the latter would normally be about one-sixth, deducting which there remains 2,644,018 tons for ore. There is some traffic in matte and other products from one works to another, but making allowance for such duplications and overestimates it seems not unreasonable to assume 2,500,000 tons of ore smelted. On this basis, namely 2,500,000 tons, it appears that the total actual profit to the company in the year ending April 30, 1903, was a little less than $2.20 per ton of ore. Inasmuch as this is determined by making the tonnage the divisor of the whole profit of the company and it is not to be doubted that even in 1902-03 the company was making handsome returns from its mercantile and investment accounts, I believe it is reasonable to assume that its profit in smelting, properly considered, at that time may have been about $2 per ton.

Average Grade of the Ore

The figures given for the fiscal year ending April 30, 1903, also convey valuable information respecting the average metal contents of the ore smelted in the United States and Mexico. Proceeding still on the assumption that the total tonnage was 2,500,000, the average was 0.41 oz. gold, 24.95 oz. silver, 197.4 lb. lead, and 19.17 lb. copper. The substantial accuracy of this deduction is confirmed by the report of the Census for 1904. (The Census confusingly designates the year as 1905, because its investigation was made at that time, but the investigation related to 1904.) According to the Census, the amount of argentiferous ore treated in 1904 was 2,271,724 tons, which yielded an average of 0.42 oz. gold, 16.53 oz. silver, 198 lb. lead, and 22.72 lb. copper. It is to be remarked that the figures of the Census relate only to ore smelted in the United States, while my previous figures have included the ore smelted both in the United States and in Mexico. Moreover, the latter figures are for contents of the ore purchased, while the Census figures are for yield of the ore. However, the agreement is sufficiently close to confirm the belief that my estimate is a close approximation.

Another interesting deduction may be made from the statistics of the Smelting Company for the year ending April 30, 1903. During that period, the average price for silver was 50¼c. per oz.; of copper, 12.452c. per lb.; of lead, 4.147c. per lb. Henry M. Adkinson, in an article in the JOURNAL of May 16, 1908, discussed the terms of a series of ore contracts made by a certain mining company, and computing the full metallic contents of the ore at the New York prices and comparing the total per ton with the amount received from the smelters showed that the portion of the value deducted by the smelters ranged from 25 to 54 per cent. The smelter's portion in five contracts out of seven ranged from 48 to 54 per cent., and the low figure of 25 per cent. was experienced only on the last contract, which was made comparatively recently with a competitor of the American Smelting and Refining Company. Mr. Adkinson's figures conveyed the impression that a great deal larger part of the value of the ore bought by the smelters remained in their pockets than is really the case. Of course, as a matter of fact, the smelter does not secure 100 per cent. of the metals, a more or less quantity being lost in the processes of smelting and refining, while of the value actually realized large portions are absorbed by the cost of smelting, refining and selling, and by freight charges. Computing ore of the average grade shown for the year ending April 30, 1903, on the basis of 100 per cent. of the metal contents at the average New York prices for silver, lead and copper, and $20.56 per oz. for gold (which is what the United States Smelting, Refining and Mining Company realized for its product in 1907, although the coinage value of gold is $20.67 per oz.) it appears that the maximum gross value of this average ore was $31.54 per ton, itemized as follows:

0.41 oz. gold	@ $20.56	$ 8.4296
24.95 oz. silver	@ 50¼ c	12.5374
197.3 lb. lead	@ 4.147 c	8.1820
19.17 lb. copper	@ 12.45 c.	2.3867
Total		$31.5357

Having already shown that the average profit per ton of ore smelted in that period was probably about $2, the actual net profit to the smelter on the basis that Mr. Adkinson figured was a little more than 6¼ per cent. of the ore value.

The Subsequent Increase in Profits

It is impossible to follow analytically the subsequent history of the company in any way that has a very sound foundation. The reports show a marvellous increase in the profits, which were $5,421,103 in 1902-03 and $9,914,253 in 1906-07. During this period of four years the amount of ore smelted by the company increased greatly, but there is no reason to surmise that it increased in the same ratio as the profits; indeed, there is sufficient evidence to warrant me in saying positively that it did not, and that if the tonnage of ore smelted in each year were made the divisor of the net profits reported the quotients would be steadily increasing. However, any such proceeding would be quite misleading in its results, because during this period the company underwent great expansion and derived greatly increased profits from sources that are not properly referable to the direct smelting operations. These will be discussed further on. The company avers that it has not increased treatment charges, and there is much evidence in support of that assertion. Its Colorado schedules are openly declared. From certain data that I happen to have, I find the following:

Cripple Creek ore: The rates vary according to the grade of the ore, but it is sufficient to compare the rates on ore containing 1 oz. gold. In 1897, before the Trust was in existence, this ore fetched $19 for the gold, less $10 for freight and treatment; in 1908, its value is $20, less $6 for freight and treatment. Ore containing 2 oz. of gold netted $28 in 1897 and $32 in 1908.

Clear Creek-Gilpin lead ore: The rates vary according to the percentage of lead. Comparing the rates on ore containing 25 to 30 per cent. lead. In 1897, gold was paid for at $19.50 per oz., silver at 95 per cent. of the New York quotation, and lead 45c. per unit ($4 basis) less $5 treatment charge. In 1908 the terms for gold

and silver are the same, but the lead realizes 49c. per unit ($4 basis) and the treatment charge is $3 on neutral basis; on the "flat schedule" the treatment charge is $5; the neutral schedule is used when it figures better for the shipper.

Leadville carbonate ore: 1897. Gold, $19 per oz.; silver, 95 per cent.; lead, $4 basis. Ore containing 25-30 per cent. lead, 43c. per unit; $1 treatment. Leadville delivery. 1903. Same rates as in 1897. (This ore has always been in great demand and the smelter's margin was early narrowed down to the irreducible minimum.)

In the report of the Smelting Company for the year ending April 30, 1906, Daniel Guggenheim, the president, states that "the increase in the earnings of the company have not been due to increase in treatment charges made to miners, but on the contrary such charges have been in many instances decreased. It is the policy of the directors to decrease treatment charges to miners and thus to encourage production wherever the same can be done, and at the same time leave a reasonable assurance of profit to the company. The increase in earnings has come in the past and must come in the future from economies in operating expenses, and an increase in the volume of business due to the encouraging of production in territory tributary to works already established and to the opening up of new territory."

There is considerable evidence that in this respect the company has practiced what it has preached, and there is no good reason to doubt the assertion of the officers of the Smelting Company that they have given the producers of ore the benefit of a large part of the administrative and metallurgical economies that they have effected, and that the charges for treatment have been reduced, considering the general average. It stands out clearly in the reports of the company that its main policy is to swell its earnings by increasing the volume of its business, and in the line of that policy it is essential to stimulate the production of ore.

Policy of the American Smelting and Refining Company

The reports of the American Smelting and Refining Company make certain general statements which are instructive in connection with this study of the present position of the company and its relation to the mining industry. Memoranda of these statements are made in the following paragraphs:

April 30, 1903. The policy of the directors has been to centralize operations at the most advantageous points, thus reducing administration expenses and obtaining more economical work. It has been found advisable during the last two years to close down a number of plants, some of which are held in reserve, while others of small capacity, or of unfavorable situation, have been dismantled. At the end of the year there were in operation smelting plants with a capacity of 3,720,000 tons per annum; refining plants with a capacity of 340,000 tons of lead bullion and 36,000 tons of copper bullion per annum. Held in reserve were smelting plants with a capacity of 650,000 tons per annum, and refining plants with a capacity of 125,000 tons of lead bullion per annum.

April 30, 1904. At most of the plants the cost of operation has been reduced by means of the extraordinary improvements instituted. Some of the surplus earnings of the company have been invested in the stock of lead manufacturing companies. The American Smelters Steamship Company was organized to conduct the traffic of the Smelting Company between Perth Amboy and Mexico and South America. The stock of the Steamship Company is entirely owned by the Smelting Company. The rate of freight charged has been the lowest made by any of the established lines, but the Steamship Company showed a profit of $93,005 during the year.

April 30, 1905. The increase in the investment account of $2,302,270 is due to the purchase of 25,000 shares of Series B, preferred stock, of the American Smelters Securities Company. The directors considered it more advisable to invest part of the cash surplus in a 5-per cent. security, guaranteed by its own earnings, than to have the money remain on deposit in a trust company at a low rate of interest. The smelting company also acquired 177,510 shares of the common stock of the American Smelters Securities Company of the par value of $17,751,000, the value of which is not shown in the investment account. The policy of the directors is to make long time contracts for the product of all important mines tributary to the plants of the company and large tonnages have been placed under contract for periods extending from 10 to 25 years. The exclusive right to the use of the Huntington-Heberlein patents in the United States has been acquired; also the right to use them at the works of the company in Mexico. As soon as these improvements have been instituted and the various works, the construction of which has been authorized, are in operation, the earnings of the company will be materially enhanced. In making the distribution among the employees, according to the profit-sharing plan, the directors state their belief that the encouragement given to the employees by this distribution of earnings has had no small influence in bringing about the very satisfactory condition of prosperity enjoyed by the company during the year.

April 30, 1906. The increase in the earnings has been due both to an enlarged business and efficient and careful management. The valuation on the books of the company of silver, lead and copper in ores is so much below the present market value that the directors have deemed a further credit to metal account unnecessary this year. The increase in the value of metal stock during the year, amounting to $3,000,000, is due to the enlarged capacity of the works of the company, and the development of mineral resources tributary to the plants of the company.

The amount of gold refined during the year amounted to over $50,000,000. While the mines of the American Smelting and Refining Company have been purchased and operated mainly for their value in assuring a steady supply of certain classes of ores for the smelters of the company, yet these mines have been profitable directly from their operations and they now constitute a very valuable asset of the company. It has been the policy of the directors to use the profits of this investment to liquidate the original cost of purchase and the continuing cost of development. Early in the present fiscal year these outlays for purchase and development will have been entirely covered by the profits of the department, and the directors expect to carry the profits of the mining department to the credit of profit and loss, beginning with the fiscal year ending April 30, 1907. The company has not included in its financial statement earnings from the following sources: 1. Use of Huntington-Heberlein patents. 2. Mining properties of the company. 3. Stock of the American Smelters Securities Company. 4. Stock of the United States Zinc Company. 5. Stock of the United Lead Company. However, subsequent to April 30, 1906, the directors effected a sale of a portion of the stock of the United Lead Company and therefore the profit accruing from this sale will be carried into the accounts for the fiscal year ending April 30, 1907.

April 30, 1907. The profit of the mining department has been used during the year to liquidate completely the entire cost of purchase and the continuing cost of development of the mines of the company.

Explanation of Increasing Profits

Reverting now to the subject of the increasing profit shown by the reports of the Smelting Company, it is important to consider a variety of conditions. It is well known that it is much more economical to smelt on a copper basis than on a lead basis. The difference in favor of the former is fully $1 per ton of ore. Consequently, the more copper ore to be smelted, the more the profit, and the increasing net earnings of the Smelting Company are doubtless due to some extent to the increased amount of ore

smelted on the copper basis. It is also well known that the margin on ore purchased in Mexico is much greater than on American ores, and a large part of the profit of the Smelting Company is derived from its Mexican business, which has been rapidly increasing. The lowest margin, probably, is realized by the smelteries in Colorado, which buy and treat in the neighborhood of 1,000,000 tons per annum and operate rather uniformly at that rate. A few years ago, the profit in smelting in Colorado was only about $1 per ton, and probably it is no larger at the present time. The increase in the earnings of the Smelting Company has also been promoted without doubt by its profit-sharing system, which was designed to increase efficiency and has had that effect. The company has benefited from economies in administration, as is clearly shown by the decreasing amount to the account of general expense. Furthermore, it has derived great advantage from the introduction of metallurgical improvements, such as the Huntington-Heberlein process, and the concentration of operations at the most economical plants.

Metal Stock Account

Finally, we come to the question of metal stock account, wherein the purchaser of ores may lose or make a great deal through fluctuation in the value of the metals. In the long run such fluctuations are expected to balance, and temporary gains or losses are commonly charged to an account representing quotational profit or loss.

In a long upward trend of prices, a buyer of ores may realize a great profit; and similarly in a sharp decline, he may suffer immense losses. From 1901 to the end of 1907 the general trend of the metal markets was upward, as is shown in the accompanying table of the prices of copper, lead and silver. It is not quite clear from its official report how the American Smelting and Refining Company adjusts its metal account, but undoubtedly the greatest factor in the increase in net income up to April 30, 1907, has been the appreciation in the value of metals on its hands, just as since June, 1907, its net income has suffered severely from the decline.

AVERAGE PRICES OF METALS.
(AT NEW YORK)

Year.	Silver, Per Oz.	Lead, Per Lb.	Copper, (a) Per Lb.
1902	52.16c.	4.069c.	11.626c.
1903	53.57	4.237	13.235
1904	57.22	4.309	12.823
1905	60.35	4.707	15.590
1906	66.79	5.657	19.278
1907	65.33	5.325	20.004

(a) Electrolytic.

The company carries in its statement of assets an item of "metal stock" ranging from $16,418,543 to $19,415,200, which represents its valuation of ores and metals on hand. The nature of its business requires that large quantities of ore and crude metal be in stock at all times. It appears from the data deduced in this article that the stock necessarily carried is from 20 to 25 per cent. of the annual turn-over; in other words the ore and its products are in process of treatment and in transportation for 2½ to 3 months. It has been the practice of the company to write off from its earnings in certain years a varying amount for "metal account" to offset a possible depreciation in the stock on hand, but since 1905 no such allowance has been made.

Control of the Markets

The administration of the American Smelting and Refining Company has gradually passed through a process of enlightenment in respect to its subserviency to the natural law of supply and demand. Several years ago it had a notion that it could exercise some control upon the price of silver and in 1902 it made contracts with ore producers, stipulating that silver was to be paid for at the rate of 95 per cent. of the New York price, but if the price should exceed 60c. per oz., one-third of the excess over 60c. per oz. was to be deducted from the price of silver used in settlement under the contracts. This was to be the smelter's commission for elevating the price. It was soon learned that the company was upon dangerous ground in attempting to manipulate the price of silver, and the attempt was abandoned in favor of the policy of selling each day the same amount of silver that is taken in, the sales being made at whatever is the market price. This put the company in a sound position in so far as the business in silver was concerned, and by virtue of contracts, an equally sound position was achieved with respect to the copper business. With respect to the lead market, however, the company continued the attempt to control the price, and was successful therein so long as the market was a generally rising one, but when the prolonged decline began in 1907, it was found that the control could no longer be maintained, and the company was obliged to recede from its position in this market.

Nevertheless, the control over the price of lead which was exercised by the Smelting Company from 1902 to 1907 was without doubt largely contributory to the increase in the net earnings shown by its reports for those years. Distinctly, this did not come out of the pockets of the ore producers, but on the contrary came out of the pockets of an entirely different class of persons. The effect of the American Smelting and Refining Company upon the lead market, so long as it had control thereof, was to elevate the price for that metal above the figure that would, in all probability, have represented the market under normal conditions; this is said with full recognition of the moderation of the company in refusing to jack up the price still further in 1906, when it unquestionably had the ability to do so. As representative of the interest of the Smelting Company in obtaining a high price for lead may be mentioned its contracts with some of the producers in the Coeur d'Alene (the chief source of silver-lead ore in the United States) providing that the producers be paid for the lead content of their ore at the market price for lead when 4.1c., or under, but in the event that the price be higher than 4.1c., payment is made to the producer at only one-half of the excess, the advantage of the other half going to the smelting company. Since 1902 the annual average price for lead has been steadily in excess of 4.1c. per lb. The bill for the premium over what might have been the natural price has been paid by the consumer; the ore producer has participated in the profit. Moreover, the American Smelting and Refining Company, along with the other smelters and refiners, has derived a certain advantage from the "exempt" lead obtained from Mexico and Canada, purchased on the basis of the London price, which is always much lower than the New York price. The foreign lead ore and base bullion are brought into the United States for smelting and refining in bond, but according to Treasury rulings, allowance is made for loss of 10 per cent. of the metal in the process; the actual loss being much less than that, the smelters obtain a considerable quantity of foreign lead, purchased at a low price, which can be used for domestic consumption free of duty.[1] There is a variety of such conditions which have assisted the smelters.

The Adverse Conditions of 1907

It is well recognized that a sound opinion as to the status of any company cannot be based upon its showing for a single year; it is necessary to analyze the results for a series of years. In the case of the American Smelting and Refining Company we have official statements for a long series of years, but even so it is impossible to arrive at final conclusions as to its capacity as a money earner, because the years heretofore have been generally prosperous ones. We must await the showing of one or two years of less favorable conditions. There is every reason to anticipate that the report of this company for the year ending April 30, 1908, will be of decidedly different color from the previous ones, in spite of the fact that conditions did not become serious until the last quarter of the calendar year 1907. However, the report of

[1] We may roughly estimate the amount of this profit in the aggregate to all of the refiners. The average price of lead at New York in 1906 was 5.657c. per lb.; at London, 3.782c.; difference, 1.875c. = $37.50 per ton. Imports of lead in ore and bullion from Mexico and Canada, about 75,000 tons. Exempt lead, probably about 5500 tons, or $206,250 at the difference between New York and London prices.

the United States Smelting, Refining and Mining Company for its fiscal year 1907, which corresponds with the calendar year, gives an inkling of what may be expected. This company (which is the chief competitor of the American Smelting and Refining Company) out of a gross production of $18,408,655, realized a gross profit of $1,827,590.99, which was diminished by $120,009.25 for depreciation and reserve funds, $166,317.58 for administrative and legal expenses, and $733,255.09 for writing down the book value of metals unsold at end of the year, including metals in process and in ore stocks, to the market value at Dec. 31, 1907. Deducting these items, the actual net profit for the year was $807,999.07.

The United States Smelting, Refining and Mining Company in 1907 produced 38,518,378 lb. of copper, 53,617,324 lb. of lead, 6,739,269 oz. of silver, and 235,822 oz. of gold. This company makes reports which are far superior to those of the American Smelting and Refining Company with respect to taking its stockholders into the confidence of the management; indeed its reports are far more frank than those of the generality of public companies, but it fails to communicate the information required for a technical analysis. However, it is stated that the United States Smelting Company, one of its constituents, handled 659,306 tons of charge in 1907, which may be estimated as representing upward of 527,445 tons of ore (estimating 80 per cent. of the charge). The Mammoth Copper Mining Company, another of its constituents, produced, and doubtless smelted, 201,123 tons of ore. We may assume, consequently, that the company smelted at least 728,568 tons of ore. On this basis the net profit, namely $807,999, was only $1.10 per ton of ore (which does not include any of the profit derived by the subsidiary refining company). However, this profit represents not only what the company achieved in smelting, but also what it realized from mining, inasmuch as by far the larger part of the ore smelted was derived from mines owned by itself, their output being 406,748 tons, besides which its subsidiary, the Richmond Eureka Mining Company, produced 32,467 tons, leaving only 289,353 tons for outside custom ores. If we disregard the loss through depreciation of metals, the net earnings of the company were about $2.10 per ton of ore smelted, which is surprisingly small in view of the large tonnage of ore produced by its two rich mines, viz.: the Centennial-Eureka and the Mammoth.

The Division of Ore Value

Now let us see what division is made of the value of an ore assaying 0.41 oz. gold, 24.95 oz. silver, 197.3 lb. lead and 19.17 lb. copper, which was the composite of all the ore bought by the American Smelting and Refining Company in 1902-03. The smelter and refiner probably realize from this ore approximately as follows:

Gold, 0.41 oz. gold @ $20.56	$ 8.43
Silver, 24.95 oz. × 0.97 @ 50¼ c.	12.16
Lead, 197.3 lb. × 0.94 @ 4.147 c.	7.69
Copper, 19.17 lb. × 0.7 @ 12.45 c.	1.67
Total	$29.95

The expenses from the time of receipt of the ore at the smelting works to the sale of the refined metals are approximately as follows:

1. Smelting, 1 ton @ $4.50	$4.50
2. Converting, 40 lb. copper matte @ 0.7c	0.28
3. Freight on 190 lb. lead bullion @ 0.43c	0.82
4. Freight on 13½ lb. copper bullion @ 0.5c	0.07
5. Refining 190 lb. lead bullion @ 0.38c.	0.72
6. Refining 13½ lb. copper bullion @ 0.7c.	0.09
7. General expense	0.40
8. Amortization	0.25
9. Tie-up of metals	0.30
10. Metal account	0.30
Total	$7.73

1. As previously computed. 3. The rate of 0.43c. is the mean of the rates from Salt Lake and Pueblo; this assumption is necessarily arbitrary. 4. In this case also the assumption of freight rate is necessarily arbitrary. It is intended to cover all freight charges on copper from the time of leaving the first smelter. Copper matte goes to Omaha from East Helena, Salt Lake, Denver, Pueblo, and elsewhere—even from Perth Amboy—and the copper bullion thence goes to Perth Amboy. Probably the assumption of 0.5c. per lb. to cover all of this movement is too low. 7, 8. These figures are deduced from the reports of the American Smelting and Refining Company; the allowance for amortization appears to be too low. 9. As previously computed. 10. This appears to be the average allowance that has been made by the American Smelting and Refining Company, as insurance against depreciation of metals on its hands.

Inasmuch as the smelter is supposed to realize a profit of $2 per ton of ore, the total deduction for its account must be $7.73 + $2 = $9.73, and from the value of the ore, $29.95, there is left $29.95 — $9.73 = $20.22 to pay for the ore and the freight upon it to the smelting works.

Now let us see how that would figure out to the producer. We may assume a settlement on the lines of the following:

Gold, 0.41 oz. @ $19.50	$ 8.00
Silver, 24.95 oz. × 0.95 × 50¼ c.	11.91
Lead, 197.3 lb. @ 2 c.	3.95
Copper, 19.17 lb. @ 5.45 c.	1.04
Total	$24.90
Less treatment	4.68
Net value to producer	$20.22

This corresponds to an ore contract reading "Gold to be paid for at $19.50 per oz.; silver at 95 per cent. of the New York quotation; lead at 40c. per unit; copper at the New York quotation, less 7c. per lb.; treatment charge, $4.68 per ton; neutral basis; delivery at smelter's works." This has a familiar sound, except that so small a percentage of copper is not always paid for, but it must be remembered that I am here figuring on a composite ore, the copper of which is obtained chiefly in special classes of a higher average than the average of all ores smelted. Many producers in 1902-03 received less favorable terms than those reckoned above; others more favorable. The reasons for the difference have been well explained by Mr. Grabill in an article in the JOURNAL of July 11, 1908; also in numerous other articles and books, including my "Lead and Zinc in the United States," pp. 46-47. But the general average in 1902-03 must have been approximately as here calculated, else the profit reported by the American Smelting and Refining Company would have been otherwise than as stated.

Of course the ore producer does not receive so much because the freight on the ore from mine to smelter has still to be paid. Unfortunately there is no means to determine what was the general average of freight charges. It ranged from the $1 per ton from Bingham to Murray, to the $8 per ton from the Cœur d'Alene to Denver, and upward for transportation from more remote points, and particularly transportation in Mexico. I hazard the guess (and it is nothing but a guess) that the average freight on 2,500,000 tons of ore smelted in 1902-03 was $5 per ton. On that assumption the average yield of the ore was $15.22 at the mines. However, this is purely speculation. Still there can be no question that the railways' share of the business is a large one.

Conclusions

After a consideration of the data presented herein, it is impossible to escape the conclusion that the great increase in the net earnings of the American Smelting and Refining Company from year to year, is to be attributed to:

1. Enlargement in the volume of business.

2. Institution of economies (a) in administration; (b) through centralization of operations; (c) through metallurgical improvements; (d) through increase in operative efficiency.

3. Appreciation in the value of metals, due partly to natural causes and partly to manipulations by the company. The profits on exempt lead, and on contracts with the producers of lead ore, whereby the value in excess of a certain price per pound is divided between the producer and the Smelting Company, must contribute largely to the treasury of the company. Since the middle of 1907, the depreciation in the value of metals has offset some of the gain previously realized.

4. Increase in the amount of ore smelted on the copper basis, which is more profitable than the lead basis.

5. Increase in earnings of subsidiary companies, such as the Steamship Company.

6. Earnings from investments of surplus, e. g., the preferred stock of the American Smelters Securities Company.

7. Profits from investments, e. g., the sale of a portion of its holding of the stock of the United Lead Company, carried into earnings for the year ending April 30, 1907.

Looking at the American Smelting and Refining Company from the standpoint of the investor, the showing made by its official reports is impressive. While paying large dividends upon its preferred and common stock, it has accumulated an immense surplus, part of which is carried in cash and part is invested in enterprises that are certain to be profitable, such as the American Smelters Securities Company, although the Smelting Company does not yet give itself credit for its large holding of the common stock of the Securities Company. Similarly, there are other interests which do not appear in the income account of the Smelting Company, it being the policy of the company to bring these enterprises to maturity before incorporating their yield in the income account. Thus, the Smelting Company has extensive mining interests, which have been profitable, but their returns have so far been used to cancel the amount invested in them. Apparently it will be only a short time before the net yield of many of these enterprises will figure in the income account of the Smelting Company. The last statement of the latter was indeed like that of the man who is reluctant to believe that he is rich.

The position of the Smelting Company being so strong in these respects, and the surplus which it carries being so large, the company may easily be forgiven for not writing off anything for amortization of its plants. As I have previously pointed out, the outlay made on account of extraordinary improvements is of the nature of an amortization account, but the amount expended so far in this way is of doubtful sufficiency. The smelteries and refineries now owned by the company must be worth in the neighborhood of $15,000,000, i. e., it would cost that amount to replace them. The average amount expended for extraordinary improvements during the five years ending with April 30, 1907, has been a little less than $750,000 per annum, which is only 5 per cent. of the physical value of the plants. Perhaps the actual net income of the company ought not to be figured quite so large as it does; however, as I have previously remarked, the surplus of the company is amply sufficient to take care of any deficiency in this respect.

Elmore Oil Process Patent Decision

In February, 1907, the British Ore Concentration Syndicate, Ltd., and A. S. Elmore began suit in London against Minerals Separation, Ltd., an English company, claiming among other things, "an injunction restraining the defendants, their servants, agents and workpeople from importing into, selling, offering for sale, supplying and using in this realm ores or mineral substances treated by any one of the processes described and claimed respectively in the Specifications of Letters Patent numbered 21,948 of 1898 and 6519 of 1901 of which the plaintiffs are the registered legal owners."

The case was heard by Justice Neville who pronounced judgment on July 18, 1908, in favor of the defendants. The judge made the following statements: "It seems to me, therefore, that on giving what seems to me a perfectly fair construction of Elmore's specification, that is, that the essence of his invention is the making use of the known law of selection of oil with a view to obtain the carrying up of the particles by the oil to the surface, is a different thing from making use of the same law for the purpose of greasing the particles in a way which does not affect their specific gravity, and then making what I think is an ingenious use of the law of surface tension by agitation and enabling the particles to be carried up by the operation of air bells.

"I come, therefore, to the conclusion that with regard to the 1898 patent there has been no infringement by what the defendants have been doing.

"I think, therefore, in that case, whether you take it that the patent is confined to the 1898 patent or whether you take it generally, the defendants have not infringed a patent which has no validity, and consequently no relief can be granted against them. I think, therefore, that the action fails, and must be dismissed with costs."

Minor Mineral Products of North Carolina

By Joseph Hyde Pratt*

There continues to be a large demand for the quality of talc such as is found in Swain county, North Carolina, and which is now produced only by the North Carolina Talc and Mining Company, of Hewitts. This is an exceptional quality of talc, and the deposits cannot supply the demand. The State has been pretty well prospected for similar deposits, but thus far none have been located, although large deposits of other qualities of talc, suitable for grinding, and for the manufacture of soapstone tubs, etc., are known. During 1907 the quantity of talc produced was somewhat in excess of that of the previous year and amounted to 4085 tons, valued at $74,347. This was obtained by seven producers in Alleghany, Jackson, Moore and Swain counties. Five quarries that were formerly producers of this mineral made no production in 1907.

Where formerly practically all of the talc mined in North Carolina was shipped out of the State, there is now a certain amount of the ground talc utilized by the Talcum Puff Company, of Asheville, N. C., which is a manufacturer of talcum powders. It produces its own talc in Swain county, and on account of its pure quality they are able to put on the market an exceptional quality of talcum powder.

The barytes industry in North Carolina is not a large one, although the quality of the barytes produced is equal to any. It is hard and compact and usually very free from iron stains. Its hardness and compactness make it a little more difficult to grind than the softer barytes. During 1907 there were 5785 tons of crude barytes produced from Madison and Gaston counties. This was valued at the mine at $18,855, an average of $3.25 per ton. A considerable portion of the barytes mined in Gaston county is ground where produced, but the balance is shipped out of the State in the crude condition.

The production of graphite in North Carolina has always been small and has never amounted to more than a few hundred tons per year. Its use has been for foundry facings and it is of rather inferior quality. During 1907 no graphite was shipped.

*State geologist, Chapel Hill, N. C.

Note—The statistics relating to talc and soapstone and barytes were collected by the U. S. Geological Survey in coöperation with the State Survey.

Prize for Best Collection of Minerals from Ontario

A prize of $100 in cash is offered by J. B. Tyrrell, mining engineer, of Toronto, for the best collection of minerals gathered in the Province of Ontario during the year 1908 by anyone not employed as a collector by a public institution or dealer in minerals. The collection must contain at least 30 mineral species, and it is suggested that where convenient the size of the specimens should be 2x3 in. Each specimen must be labeled with the exact locality from which it was obtained, and the date on which it was found. No specimen will be considered unless it is so labeled.

A typewritten list of the specimens, with names of minerals and localities, in triplicate, together with a declaration stating that they were personally collected by the signer of such declaration, in the Province of Ontario in 1908, at the localities stated, with the post-office address of the collector, must accompany each collection.

The collections must be addressed: "Examiners, Tyrrell Prize, Government Assay Office, Belleville, Ont.," and must be sent, *prepaid*, to the Government Assay Office, Belleville, Ontario, on or before Dec. 1, 1908, where they will be opened and examined jointly by Professor Nicol, of the School of Mining, Kingston, and Doctor Walker, of Toronto University. If requested the collections will be returned, charges collect, as soon as possible after the prize is awarded.

Duluth Steel Plant and Belt Railway

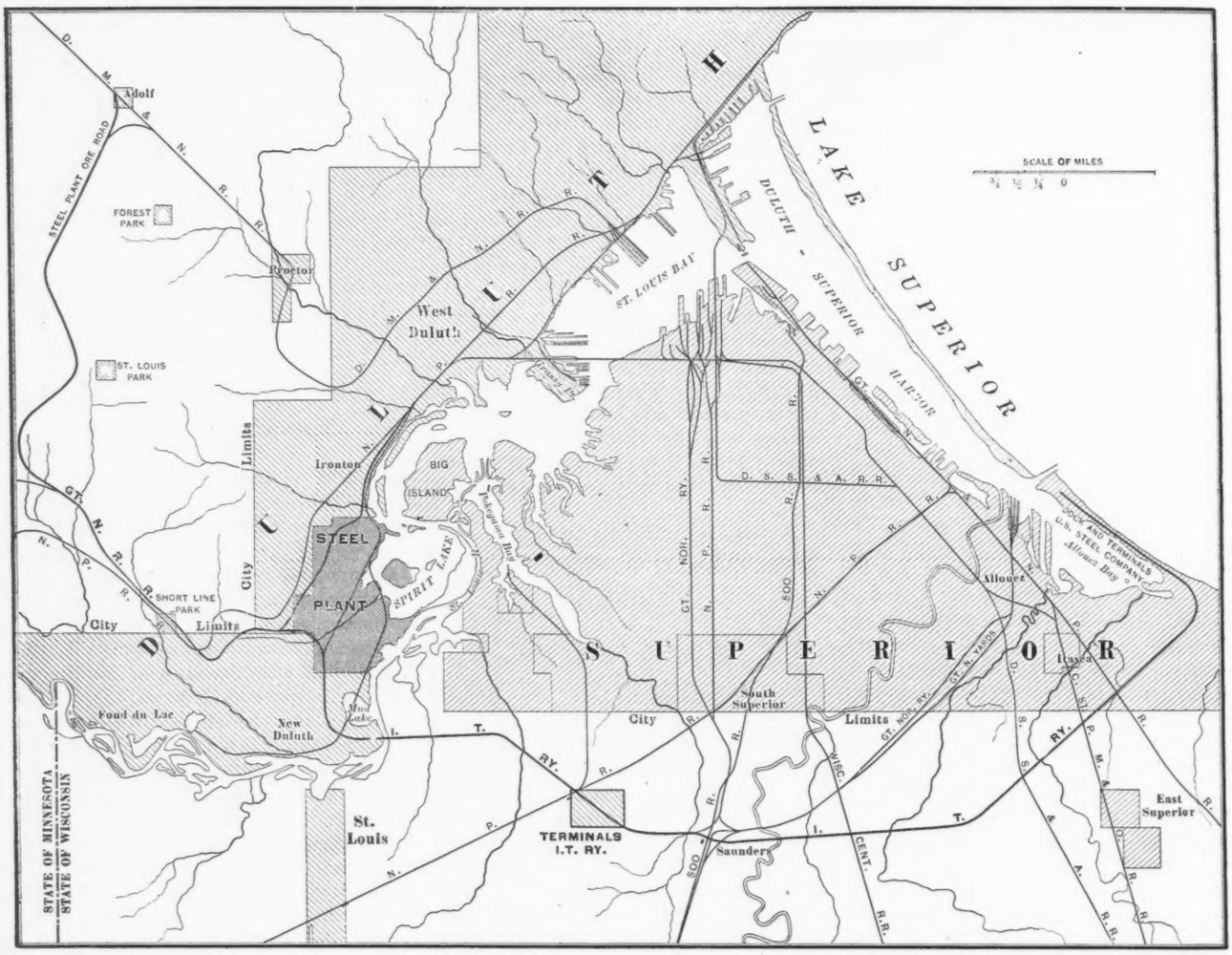
By Dwight E. Woodbridge

In connection with its proposed steel works at the head of Lake Superior the U. S. Steel Corporation has planned a belt railway line for the Duluth and Superior terminal system that will not only give it access to every railway that now enters, or will in future enter, the region, but will provide ample room for any manufacturers that may wish to avail themselves of the raw-steel products to be rolled at its works.

Three railway incorporations have been made, which cover the situation. Combined, these will leave the line of the Duluth, Missabe & Northern, which is the steel corporation's road from the Mesabi range to Duluth, at the village of Adolph, and will follow an old and abandoned grade built by the Duluth & Winnipeg to the site of the proposed works; it will cross the St. Louis river into Wisconsin, run back of the city of Superior, crossing every road to the head of the lakes but two or three that come in on the Minnesota side, and will swing around to the base of Wisconsin point, running up that stretch of land to its end.

There will be about 30 miles of road, and a large double-deck swing bridge across the upper part of the harbor. Congress has already authorized this bridge. The road will not only be a great convenience to the steel company, relieving it of all danger of delay from congested traffic in city terminals, which is a constantly growing evil, but will enable it to assist other roads, at profit to itself, in handling their transfer and terminal freights. The construction of this road has begun and will be pushed to completion, as it is hoped to have it running this year.

Operations on the Minnesota Steel Company's works so far have been merely preliminary, but it is expected that before the close of the summer activity will be more marked. So far the steel corporation has not definitely decided as to the extent of the Minnesota Steel Company's operations, but the original plans have already been found too small, and the works will probably be of fair size.



MAP OF DULUTH AND ENVIRONMENTS, SHOWING POSITION OF NEW STEEL PLANT AND ROUTE OF BELT RAILWAY

The Detection and Identification of Manganese and Chromium

Professor Karslake[1] recommends the following method for the detection of manganese and chromium in the same solution. To the cold dilute nitric or sulphuric-acid solution of the substance to be tested add 1 or 2 c.c. silver nitrate solution of ordinary concentration, then a relatively large amount (2 to 5 grams) of solid potassium persulphate, and then carefully heat the whole until the evolution of oxygen, due to decomposition of the persulphate, is practically over. This converts the manganese into permanganic acid and the chromium into chromic acid. The permanganate color shows itself first and usually obscures the chromate color. In order to detect the chromium, shake cool solution with one-fourth to one-third its volume of ether and add peroxide of hydrogen in excess. This will convert the chromic acid to perchromic acid. The method may be easily and rapidly performed in an ordinary test tube.

[1] *Journ.* Am. Chem. Soc., May, 1908, p. 905.

New Mining and Milling Practice on the Rand

Recent Improvements in Efficiency and Reduced Cost Have Put Criticism Based on Conditions of Two Years Ago Entirely out of Date

BY EUSTACE M. WESTON*

A period of severe adversity has done the mining industry on the Rand nothing but good. Costs have been so reduced that quite another aspect has been given to almost every mining enterprise in this field, and signs are not wanting to show that the inflow of capital, necessary to develop and work the ground many square miles in extent now lying idle, is to be resumed. Several idle mines, such as the Aurora West and the Bantjes, are resuming work or are about to resume work.

The lesson of the period of stress has, however, been a severe one. A selection of most of the mining and finance companies showed in the end of 1904 a valuation, according to the market, of £276,000,000. The valuation the market placed on these same companies in December, 1907, was £116,000,000. This is notwithstanding the progress made by the industry as shown in the accompanying table:

Costs per ton milled have been coming down slightly since 1905; but it was only in the latter end of 1907 and the beginning of 1908 that the most marked reductions have been shown. The cost per ton milled in 1905 was 23s. 10d.; in 1906, 22s. 3d.; and in 1907, 21s. 2d. The profit per ton in 1906 was 12s. 5d., and in 1907 12s. 10d. per ton milled. Compare these figures with those for the first four months of the present year as shown in another table.

PROGRESS OF RAND MINES, 1904-1907.

Year.	Stamps at Work.	Tons Ore Milled.	Value Output.	Working Profits.	Dividends.
1904	4795	80,022,736	£15,453,312	£5,800,000	£3,821,846
1905	6521	11,160,422	19,991,658	6,700,000	4,898,970
1906	7527	13,571,554	23,615,400	8,500,000	5,580,97
1907	8245	15,523,229	26,421,837	10,000,000	7,007,41 1

IMPROVEMENT DURING FOUR MONTHS OF 1908.

	Value Per Ton Milled. Shillings.	Cost Per Ton Milled. s. d.	Working Profit. s. d.
January	31.91	19 5	12 7
February	32.43	19 5	13 1
March	31.57	18 8	13 3
April	32.05	18 6	13 7

Compare now market valuations and dividends declared between the years 1906 and 1907.

Dividends declared by mines having an estimated average life of 26.66 years in 1906	£5,565,972
Market valuation	56,305,227
Amount required per annum to redeem this market valuation capital in 12½ years at 3 per cent	3,728,363
Full dividend	1,837,609
Per cent. on market value yielded by shares	3.26

These are practically the figures given by a number of representative engineers before a government commission on the mining industry. The figures for 1907 are as follows:

Dividends 1907	£6,962,413
Market valuation	58,400,000
Amount required per annum to redeem market valuation in 12½ years at 3 per cent	3,971,200
Full dividend	2,991,213
Per cent. on market value	5.10

The method of averaging the life of all the mines allows of errors, if it is sought to press the comparison too far; and, of course, the case of each individual mine requires separate consideration, but this table shows that great progress has been made.

More Available Orebodies

The result is perhaps better than it seems, when viewed in the light of results of 1908, because this great reduction of costs has lengthened the life of many of the mines. In many mines the reserves of ore blocked out and before classed as non payable now becomes available. Reefs also, such as the main reef in many mines standing almost untouched will now be mined.

It was recently estimated that in the more central portion of the Rand alone there were 80,000,000 tons of ore averaging about 16s. per ton in value awaiting a lowering of costs to be available, and this lowering of costs has now arrived and its effects will be shown in the returns for 1908. Both on the far east and far west Rand there are known areas containing low-grade reefs of other series than the main reef that will, under present conditions, pay to work, the Kimberly reef and the so called Battery reef being examples. With the yield and profit mounting every month as shown by the following table for four months of this year, these properties must attract attention:

	Yield.	Working Profit.
January	£2,294,632	£878,244
February	2,212,936	872,229
March	2,350,865	950,155
April	2,308,050	953,839

In January of this year 8410 stamps and 71 tube mills were at work; in April, 8450 stamps and 73 tube mills. About 15.75 per cent. of rock hoisted is sorted out.

Results at Some Rand Mines

The following list shows the costs at some of the mines. These costs include mining, milling, ore treatment, development and administration expenses.

Geldenhuis Estate—An old outcrop mine; development finished, reefs wide; opening old stopes, removing pillars, etc.; 120 stamps; 14s. 2d. per ton milled; much machine stoping.

Glencairn Main Reef—Development nearly finished; 135 stamps; 14s. 7d. per ton milled; much machine stoping.

Knights Reef—A wet, deep mine; reefs far too large; much machine stoping; development costs about 31s. per ton; 200 stamps; costs 16s. 4d. per ton milled.

New Goch—Outcrop mine; reefs small, much faulted; stoping almost entirely by hand labor; a difficult mine to work; costs per ton milled, including about 3s. per ton for development, 16s. 11d.; stamps, 120.

Robinson—The premier mine on the Rand outcrop; large reefs; development costs only a few pence per ton; 210 stamps; cost per ton milled 12s. 10 pence.

Robinson Central Reef—A compact deep level; large reefs; 155 stamps; cost per ton, 14s.; large proportion rock broken by machines.

Robinson Deep—Workings from 2000 to 3000 ft. depth; costs per ton milled 16s. 11 pence.

Roodepoort United Main Reef—Outcrop; reef principally worked only a few inches thick; ground very heavy requiring about 2s. per ton for timber; 110 stamps.

Simmer & Jack—Outcrop and deep-level shafts; reefs large; development costs normal; 320 stamps, largest single battery on Rand; costs per ton 13s. 11 pence.

Van Ryn—Outcrop mine; reefs small; most rock broken by hand; development costs 3s. per ton; stamps 160; cost 18s. 11d. per ton milled; most of these mines have tube mills besides the stamps.

Some of the mines with higher costs are:

New Randfontein—Stamps, 120; worked by resueing; costs 30s. 2 pence.

New Railfontein—Stamps, 120; working an erratic and narrow reef series north of the main reef; 25s. 1 d., costs per ton milled.

Main Reef West—Stamps, 30; similar to Windsor; costs 26s. 11 pence.

Jumpers—Old mine; nearly exhausted; working old ground by resueing; 70 stamps; costs 32s. 2 pence.

Durban Roodepoort Reef—Stamps, 50; similar to Roodepoort United Main Reef, but a deep mine; costs 28 shillings.

*Brakpan, Transvaal.

Some of these costs compare favorably with those of any other field and remove the reproach of inefficiency brought against the miners and superintendents of the Rand.

How the Economy was Effected

How have these economies been brought about? Stores have been bought more carefully, many of the group having now a central laboratory to test materials supplied. Stores have been used more carefully as their consumption has been checked. On some mines the oil bill alone has been diminished £50 to £100 per month.

Greater efficiency has been gained from those in charge. Several of the groups have done away with the cumbersome and useless system of having a general manager and a huge central office staff supposedly to check the work of the mine managers. A consulting engineer is employed to give advice, and a central drawing office with designers and a chief mechanical engineer meet all other needs; while a managing director can do all other work in the control of the policy of the mines. Though cost keeping is still run to ridiculous extremes on some mines, as on one mine where stores were divided over 1700 accounts; yet, on the whole, the system is now used sanely, and gives the required information with less labor.

New inventions and appliances in ore treatment have also reduced costs. Mills have been enlarged and tube mills installed enabling a greater tonnage to be put through with the same administrative cost. Further reduction of surface cost is looked for in the more extended employment of large central works for supplying electrical power to numerous mines. Explosives have improved in quality, and shortly a reduction of 8 to 10 per cent. in prices is expected owing to greater competition. The present cost of best blasting gelatine is about 52s. 6d. or $12.6 per ton.

Underground the recent strike gave the management a chance to find out what men could really do in stoping and development, and to ask something approaching this from them. In development work alone prices have been reduced from 5s. to 10s. per foot, and the men in some cases earn as much as they did before. Stoping costs with machines have also been reduced.

Native Laborers Plentiful

Everywhere the proportion of both white and native labor has been reduced per ton mined and greater efficiency has been gained. The native is coming to work in large numbers owing to the failure of the diamond industry and the cessation of public works in South Africa due to the depression. The Chinese, working on contract, have shown what can be done in shoveling and drilling single jack and this work is now being asked of the native, and wages for natives have been reduced. In many mines the native now has to clean down the broken rock to the bottom of his stope before starting drilling. He is required to shovel for two hours and then to drill 42 in. instead of 36 in. as formerly. Contract prices for tramming have been cut down all around, though on some mines the tramming contractor still makes £200 to £300 per month.

Air Pressure and Drill Steel

Mine managers and engineers on the Rand have at last begun to wake up to the losses of efficiency of air machinery underground. Much remains to be done; but things are not now as bad as they were two or three years ago. Long ago I protested against the idea of running rock drills with 40 to 50 lb. pressure and called for tests showing the loss of pressure due to defective and small pipe lines. At last these matters are receiving attention, and in some mines by increasing the size of air mains pressures have been raised 10 or 15 lb., and the tons broken per shift raised correspondingly.

An eminent American engineer was recentiy employed to report on Rand costs and he apparently overlooked this vital matter entirely, merely remarking that the air pressures on the Rand were from 70 to 80 lb. He does not seem to have inquired what they were at the machines themselves. Had he done so he could have laid his finger on one of the chief causes of inefficiency.

The supply of sharp drill steel was at one time scandalously bad on nearly all the mines and even now is often bad enough. On one large mine where machines are supposed to put in from four to six holes per shift an average of only about 26 sharp drills were supplied per double shift over a period of a year. This means, of course, either that the drills had to be used twice, which in hard ground cannot pay, or that the number of holes expected were not put in. Electric sharpening furnaces are now being tried with success, it is said, underground on some of the mines and may help to solve this problem.

Small Stope Drill

These are among some of the chief causes of the recent reduction of costs. The small stope drill has not yet arrived to displace hand labor. The Gordon drill has not in practice shown an efficiency anything like approaching that shown in the recent trials. An average of four to five holes per shift has been with difficulty maintained in actual work. Progress has, however, been made, and the Gordon drill will doubtless be improved. The Murphy drill is said to be showing good results on the Robinson mine. The conditions for the competition for the £4000 prize offered by the government for the stope drill weighing under 100 lb. that during six months with two machines working will put in the most holes for the lowest costs are now published and should attract competition from all over the world.

Assay of Lead

The chromate-oxalate method is recommended by A. H. Low[1] as the best for technical work. The best results are obtained when the determination is carried out as follows: Treat 0.5 gram of ore in a 6-oz. flask by the usual methods to obtain the washed lead sulphate on a 9-cm. filter. Dissolve the lead sulphate on the filter with a jet of hot sodium-acetate solution contained in a wash bottle, receiving the filtrate in the original flask. Prepare the solvent by diluting a cold saturated solution of commercial sodium acetate with an equal bulk of water and adding 40 c.c. of 80-per cent. glacial acetic acid per liter. Agitate the extract in the flask and heat if necessary to redissolve any separated precipitate. Add 10 c.c. of a 5-per cent. solution of commercial potassium dichromate, and boil gently for a few minutes to render the precipitate basic, when it is easily filtered. The change is shown by its becoming reddish yellow in color. Filter while hot, wash out the flask with hot water and wash the precipitate once. Wash off the lead chromate with a jet of hot oxalic-acid solution, using from 25 to 40 c.c. Heat nearly to boiling in a wash bottle, add grain alcohol to the mixture in the flask and boil until the chromic acid is reduced and the lead is converted to oxalate. Remove from the heat, add 30 c.c. of cold water and cool thoroughly in cold water. When cold filter and wash the precipitate thoroughly. Place 5 c.c. of strong sulphuric acid in the flask and dilute with a little cold water and add about 125 c.c. hot water. Add the filter and precipitate and titrate with standard potassium permanganate solution. The solution used for iron determinations will serve. Theoretically, the oxalic acid value of the permanganate solution multiplied by 1.642 will give the lead value, but owing to slight losses as sulphate, oxalate, etc., the factor 1.669 will give best results. On this basis, for 0.5 gram of ore taken for assay, the solution should contain 1.5185 grams of potassium permanganate per liter so that 1 c.c. may equal 1 per cent. lead.

Tom Johnson (*Journ.* Chem., Met. and Min. Soc. of South Africa) states that he has used 7/8-in. ground steel for hand steel, instead of 7/8-in. octagonal steel, with good results. As the ground steel weighs less than the octagonal steel, more drills per ton are obtained, the drills are lighter for the men to carry, and holes are started more easily. The drills were tapered down to a small head and the head end tempered.

[1] *Journ.* Am. Chem. Soc., April, 1908, p. 587.

The San Rafael Mill at Pachuca

By Mark R. Lamb*

The San Rafael 60-stamp mill at Pachuca, Mexico, which is being built under the supervision of Edmundo Girault, the general manager for the company, is rapidly nearing completion. Several new features are combined in this mill but nothing has been employed which has not been tried out thoroughly.

Forty stamps of the battery have been moved from a former concentrating mill, and with these wooden mortar blocks are used. The other two batteries are new and heavy, and are set on strong concrete foundations, as will be the additional forty stamps to be built as soon as the present plant is in operation.

It was intended to include concentrators in the scheme of operation but the results attained by J. B. Empson by thorough agitation in Brown tanks show this to be unnecessary. The crushing will be done in cyanide solution, and as planned now the coarse pulp from the battery will, after classification, go direct to tube mills, and the slime to slime settlers. Space and fall has been provided for concentration should a variation in ore or conditions require this additional step. The tube mills are of Krupp make and are three in number.

Classification before and after the tube mills will be by means of a newly designed scraping classifier, consisting of an inclined flight of scrapers running slowly over sprocket wheels dragging the sand from a slightly inclined settling box.

The finished product from the tube mills will be conducted to three continuous settling tanks of the Dorr type in which a scraper slowly revolves and drags the settled slime to the central discharge. The thick material from these settlers will go to 10 Brown tanks, where the solution will be brought to treatment strength and the pulp strongly agitated. Mr. Empson believes that a large excess of air is necessary for good extractions on silver ores and has provided a compressor having a capacity of 1400 cu.ft. per minute for these tanks. He draws his conclusions from results of extended experiments on Pachuca and Guanajuato ores.

As his plant will treat 200 tons per day only part of the tall tanks, perhaps half, will be in agitation at one time; consequently ample air capacity and tank capacity are provided.

After the agitation in the Brown tanks is completed, the pulp is sent to settling and storage tanks where as much of the treatment solution as possible is decanted before the pulp is sent to the Moore filter. The filter will be in two complete units, each having a capacity of 150 tons per day.

The entire cyanide plant as well as the mill will be run by electric power so that few men will be needed. The battery will require the usual complement of men, but the tube mills require little attention; the settlers discharge automatically, one man per shift will attend to the Brown tanks, and only one man is required for the Moore filter. Mr. Girault is inclined to employ a large factor of safety in tank capacity, machinery strength and motive power. He says that although people who know may design the plant, after all, the *peon* must run it and things must be proportioned accordingly.

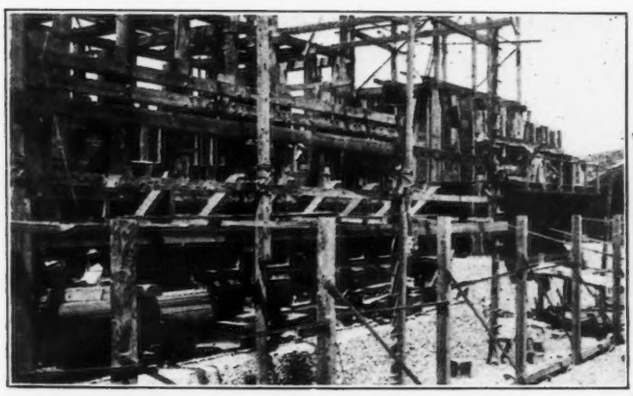
The ore from the mine treated at this mill will average about one kilogram silver per ton. Besides the mine ore, a large reserve of milling ore is provided in the form of an unsorted waste dump.

Though all of us who are interested in the silver industry are hoping that the price of silver will go up, there is no certainty of it and its production must be brought to a manufacturing basis. With such a plant as the one just described and with ore of the indicated grade, silver can be produced for 35c. per oz. Still, with silver at the present price of 53c. it should be taken at not to exceed 45c. in estimating the value of mines.

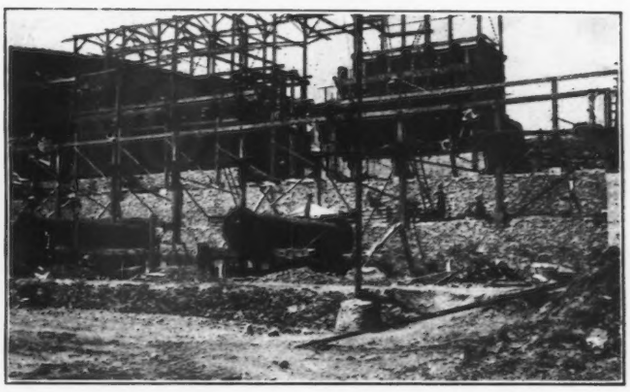
Agitation and filtration have reached a fine point; stamps are not equaled for crushing down to a mesh sufficiently fine

GENERAL VIEW NEW MILL AT SAN RAFAEL

BROWN AIR AGITATION TANKS



STAMP BATTERIES, SAN RAFAEL MILL



BATTERY AND TUBE MILLS, SAN RAFAEL MILL

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for tube milling, consequently the weakest link in the chain is the tube mill with its high power cost and high first cost. The Brown, or El Oro, liner has reduced lining cost to a very reasonable figure, and the employment of mine ore to largely replace the expensive pebble for grinders has decreased running and maintenance costs. With a little more improvement in tube-mill design, our metallurgy will be nearly on a parity, considered as a manufacturing industry, with rolling mills.

Cupellation of Silver

C. H. Fulton, assisted by O. A. Anderson, I. E. Goodner and I. D. Ossa (*West. Chem. and Met.*, IV, pp. 31-54) has made an extensive investigation of the actual temperatures of cupellation and certain other interesting phenomena in the cupellation of silver. The loss of silver and gold in cupellation by absorption and volatilization, as is well known, is a function of the temperature and increases rapidly with it. The proper temperature for cupellation is one at which feathers of litharge form on the cupel and the object of this investigation was to ascertain this temperature. Previous workers in this line have determined the temperature in various parts of the muffle during cupellation and at points in close proximity to the cupelling lead button. The main objection to such measurements as showing the temperature of the lead button, is that the heat evolved by the oxidation of the lead raises the temperature of the lead button very much above the temperature of the surrounding atmosphere. The authors, therefore, aimed to obtain the actual temperature of the lead button as well as of the surrounding atmosphere and of a similar empty cupel placed in close proximity to the one holding the lead button.

It was first attempted to obtain the temperature of the lead button by inserting in it the protected end of a thermo-couple. This method proved impracticable as the fused quartz tube first used was eaten through in a very short time, while the iron tube next used was soon surrounded by a heavy scoria of iron oxide and soon ate through. The successful solution of the problem was to insert the couple in the cupel in such a manner as to be in contact with the lead from below.

The cupels were contained in a 3.5-in. section of iron pipe, 2.5 in. long, in the side of which was inserted a 0.5-in. iron pipe closed at the end within the larger pipe. The closed end, after the pipe had been shrunk in place, was dipped into asphaltum paint, thinly covered with finely powdered chromite, heated gently until the paint thickened, dipped again in the paint, sprinkled with chromite and heated. This operation was repeated until a coating approximately 0.0625 in. thick was obtained. The cylinder was then carefully packed with moist bone ash, leaving a section of the iron tube, having an area of approximately 0.0625 sq.in., exposed at the bottom of the hollow. After a careful drying the cupels were ready for use.

The temperatures were measured with a platinum, platinum-rhodium couple and a Siemen's and Halske galvanometer. The couple and galvanometer were carefully standardized both before and during the work and at no time showed more than the allowable error within the limit of observation. A temperature curve was constructed in reference to the galvanometer readings and used in the determinations of temperatures from the readings observed. In the work, two cupels were placed side by side in the muffle, one serving as a blank and the other for the cupellation. The junctions of the platinum and the platinum-rhodium wires with the copper leads were made by brass binding screws and each junction placed in a test tube filled with distilled water. The four test tubes were placed in a graphite crucible and packed with ice so that the temperature of the junctions approximated during the experiments. By means of a two-way switch either couple could be connected with the galvanometer.

In the first experiment one of the couples was placed beside the cupel without being enclosed in a blank. After the button uncovered its temperature rose very rapidly and soon exceeded the temperature of the muffle. As the muffle cooled, the temperature of the button dropped but at a much less rate and showing at one time a temperature 145 deg. C. above that of the muffle. The lead froze at 802 deg. C. while the temperature of the muffle was 675 deg. C.

The next series of experiments in which blanks were run showed that the opening and freezing temperatures are near each other and ranged from 778 to 850 deg. C. in the cases observed. It was noted that in all cases as soon as the button uncovers there is a sharp rise in the temperature of the cupel, whether the muffle temperature rises or not, being from 20 deg. to 150 deg. C. above the muffle temperature according to the rate of oxidation, i.e., the air supply. Therefore, since the losses are dependent on the temperature, the regulation of the air supply is as important as the regulation of the muffle temperature.

The uncovering temperature being much below the melting point of litharge, it is evident that volatilization of the litharge takes place below the melting point and is a function of both the area exposed and the temperature. Furthermore, the ordinary lead button from a crucible assay has adhering to it small amounts of silicious slag, and the bone ash at times contains small quantities of silica. The formation temperatures of the lead silicates are so low that only a small amount of silica present will materially lower the opening temperature.

The temperature for uncovering is, therefore, dependent on: (1) The presence of silica in a condition to combine with lead; (2) the vaporization of solid litharge, the rate of vaporization depending upon the temperature and the relation of area exposed to volume present, for a button with a thick covering will not open at as low a temperature as one with a thin covering; (3) the presence of foreign metals in the lead, such as copper, iron, etc., which raise the uncovering temperature.

Apparently cupellation can be carried on below the melting point of litharge. The particles of litharge that form on the surface of the button, though solid, are pasty and capable of being absorbed by the cupel, but the authors suggest the possibility that the surface of the cupelling lead may be at a higher temperature than the thermo-couple at the bottom indicates.

Feathers of litharge form on the cupel walls when the walls are cooler than the cupelling lead and below or near the uncovering temperature, but they will not form above 820 deg. C. The formation of these feathers is the best available guide to the temperature of cupellation, and the actual temperature is usually from 840 deg. to 900 deg. C., although a higher temperature with a strong current of air impinging on the cupel might still yield feather litharge.

The authors next investigated the temperature changes occurring at the finishing point of a cupellation containing silver. That there is a marked evolution of heat at the finishing point was plainly demonstrated, the latent heat evolved raising the metal nearly to the freezing point of silver.

The authors summarize their work as follows: (1) In the case of the lead buttons, not containing any appreciable amount of copper or iron, etc., i.e., pure, that a muffle temperature of at least 800 deg. C., and, better, one of 850 deg., is necessary to "uncover" or start cupellation; (2) that this temperature may be lowered to about 770 deg. C., during the oxidation of the greater part of the lead; (3) that toward the end of the cupellation, or the "finishing," in case of silver, it must again be raised to about 830 deg. C., in order to get a pure silver button; (4) that the actual temperature of the cupelling lead is always appreciably higher than the muffle temperature; (5) that the actual finishing temperature of the cupellation cannot safely be carried below about 910 deg. C.; (6) that the greatest observed surfusion of silver was 77 deg. C., and that this is probably very near the maximum; (7) that silver beads finishing with surfusion are free from lead; (8) that "feathers" or crystals of sublimed litharge on the cupel are an indication of the proper cupellation temperature, provided the air draft is not excessive.

Power Systems of the Mines of the Joplin District

Of the Three Types in Use the Gas Engine Plant Shows the Greatest Economy, the First Cost Being Slightly Less Than for Steam

BY D. F. BOARDMAN*

There are few mining districts that afford as wide a range in the selection of power plants as the Southwest Missouri lead and zinc mining district. The systems employed include: (1) steam, derived from gas-fired boilers with oil burners as an auxiliary; (2) steam, derived from coal-fired boilers; (3) gas engines, direct-acting and belt transmission; and (4) electrical current. The relative cost of installation and operation, the richness and estimated life of the property, and the reliability of the plant, are the chief determining factors in making a choice.

The mines of this district may be divided into two classes according to the nature of the deposit, whether pocket or in sheet formation. The pockets may vary in size from that of a bushel basket to the dimensions of a convention hall. These pockets were the richest and first mines worked, but are so uncertain that the kind of power employed is of minor importance.

The blanket or sheet-ground mines are more continuous and offer greater inducements for the study of economy in power production. In the district north of Webb City where mining conditions are similar, there are new mills representing all the types of power production, steam, gas, and electric current. Here the operator can practically figure in advance the number of tons of ore that he will mine per acre, the estimated tons of jack, the yearly returns on the investment, and the length of the life of the mine. Care in the selection of an economical power plant is, therefore, decidedly worth while.

A fair basis for a comparison of the steam, gas-engine and electric systems would be the costs per horse-power hour. It is on this basis that electrical power is sold; but reliable and accurate data for steam and gas-engine plants are not to be had. Gas engines are of recent introduction, and the steam operators rarely trouble themselves with complete boiler and engine tests. In a group of the sheet-ground mines north of Webb City all of the conditions are practically the same. The cost of mining per ton of ore ranges not far from $1; hence for mines of like capacity a fair basis of comparison is the cost of power per ton of ore extracted. This is the basis adopted in this article and will be employed in studying the economy of the different systems. Nothing but the actual cost of power will be taken into consideration; although it may seem unfair, the cost of oil, waste, packing, repairs to engines, boilers, pumps and compressors, will be eliminated. These costs vary largely with the efficiency of the management, and in a year's run are insignificant as compared with a total of the power bill.

*Mining engineer, Joplin, Mo.

Electric Current

The Spring River Power Company is the chief source of electrical power for the district. The water-power generating plant at Lowell, Kansas, has a capacity of 3000 kw., supplemented by a 2000-kw. steam plant. The company supplies a three-phase 25-cycle curent, at 33,000 volts, stepped down at the mines to 2300 volts, the pressure generally supplied to all the motors of more than 50 h.p. capacity.

The advantages claimed for electric power are the efficient division of power into large and small units, the absence of waste when not in use, no loss in transmission, overload capacity of motors, general convenience, and special economy in pumping.

The Yellow Dog mine on the Underwriters land has the largest and most complete example of electric power installation of the mining plants in the district. The hoisting is done from two incline shafts by two 40-h.p. motors, driving an endless chain of iron elevator buckets. For each of the two 500-ton units of the mill there are: a 100-h.p. motor for the line shaft, a 40-h.p. motor for each centrifugal pump, and a 30-h.p. motor to drive the sand jig and tailings elevators in each end of the mill, a total of 170 h.p. Three 200-h.p. motors are used to drive three 1200-cu.ft. Ingersoll compressors. There is also a 5-h.p. motor for driving the deep well pump, a 30-h.p. motor on the sludge mill, and a 30-h.p. motor on the centrifugal mine pump, recently installed. A total of 1085-h.p. is supplied at a rate of 0.89c. per horse-power hour, the monthly bill for handling approximately 26,000 tons of ore being $2600. The power cost is approximately 10c. per ton of ore. In this calculation the work of nine machine drills breaking ore for the Marigold mine is included in the cost to offset the pumping done by the steam plant of the Marigold for the Yellow Dog. About 1c. per ton is charged against pumping in the power bill. The electric service has been entirely satisfactory.

Another example of electric power installation is found at the Eleven O'clock mine at Prosperity. The mill is driven by a 75-h.p. motor and handles about 150 tons of ore per shift. A 75-h.p. motor drives a 525-ft. compressor and a 15-h.p. motor operates a direct-connected three-stage turbine pump underground. Hoisting is done by a 15-h.p. variable-speed motor geared to a Sampson hoist. The total amount of material handled by this mill in seven months amounted to 28,055 tons, or about 400 buckets daily. The total power required for air for five drills, for pumping one-third of the time, and for ventilation, milling and hoisting, amounted to 275,853 horse-power hours, or approximately 10 horse-power hours per ton handled, at a cost little less than 10½c. per ton of ore. The total cost of maintenance of the electrical equipment of the plant did not exceed $15 for 16 months of continuous operation. No electrician was employed, the blacksmith starting the motors, and attending to the oiling.

Electric Current and Steam

A most interesting example of a double power installation (electricity and steam) to do the same work, was furnished some months ago at the Nymo mine, at Webb City. The water in the shaft amounted to 450 gal. per min., which had to be raised against a 220-ft. head. During the month of April, 1907, practically no work was done in the shaft, the steam and electrical pumps alternating in holding the water down. A 10-in. triplex Deane pump driven by a 75-h.p. motor handled the water for 13 days for a total cost of $79.09. At 1c. per horse-power hour the average charge was $6.08 per 24 hours. A compound steam pump with an unprotected steam line handled the same amount of water at an average cost of $13.59 per 24 hours for six days during the same month. This shows an economy for the electric pump of more than two to one as compared with steam.

Steam Plant

One of the first and most successful exponents of modern steam power installations in the district, is that of the American Zinc and Lead Smelting Company at the company's sheet-ground mines at Prosperity. The first plant erected in 1905 was of smaller capacity than that required by the three mills subsequently built, but the Corliss engine and condensing plant installed demonstrated such economy that larger plants along the same line were constructed.

The large central power plant at the Davey No. 3 mill now supplies power for air, light and pumping at all four mines.

The mill engines at the different plants are 18x36-in. Bates-Corliss, and develop from 125 to 150 h.p., the power developed depending on the tonnage handled. A 2400-ft. Imperial-Rand, and a Laidlaw-Dunn-Gordon air compressor of the same size furnish the air. A 75-kw. generator supplies power for the various motors, for lighting above and below ground. Snow condensers are used at about 23 in. vacuum. Two Snow pumps installed underground handle about 600 gal. of water per minute. Six 150-h.p. high-pressure Erie boilers, gas fired, with an auxiliary oil-burning system, supply the steam.

The compressor at this plant is a compound and condensing machine; when running alone without other demands on the boilers it showed a consumption of 38 cu.ft. of gas per horse-power hour, or a cost of 0.38c. per horse-power hour with gas at 10c. per 1000 cu.ft. The plant as a whole shows according to the company's statements a cost of 0.49c. per horse-power hour. The average of the non-condensing plants where only the hoist and mill engines are run, is 0.75c. per horse-power hour, the approximate cost of power per ton being 5.4c. as compared with 10c. per ton for electric power at the two mills described.

Another very economical steam plant is that installed at the Providence mine. The power plant is modeled on plans very similar to those of the American plant. It employs the condensing system throughout with the exception of the 8x8-in. hoist, and the 5-in. pump which has a compound steam end. The daily capacity of the mill is 350 tons and the cost for gas is $20.40. The cost of power per ton of ore is 5.8c. as compared with 10c. per ton for electric power. During June, July and August, 1907, 27,337 tons of ore were handled, the total expense for gas being $1607.70. Air for two machines employed upon ontside work, is included in this estimate which raises the cost above the true figure. The cost of power for pumping at 1c. per ton is included in the total given as 5.8c. per ton of ore.

Slide-valve Engines

The Red Dog and Bull Dog are adjoining mines, and represent the common type of steam-power plant in the district, as does the Dinger mine. The engines are all of the ordinary slide-valve type. They are run without the aid of condensers, and the feed water is heated in wooden tanks. The steam hoists and pumps are similar to those of the Providence. At the Bull Dog mine the power cost is naturally higher for the work done, it being a new mine, and being crowded for working room in opening up. The cost of power per ton is 10.5c. The Dinger is an older mine and with exceptionally favored facilities for getting ore, and hence the cost of fuel per ton is lower than normal, being 6.4c. per ton of ore.

The Red Dog mine offers a most favorable subject for comparison. It operates on the same run of ore as the Yellow Dog and the Providence, and has slightly less water to handle than the latter mine. Its daily tonnage is 300 against the 350 tons of the Providence and the method of mining, mill construction, and total work done, are all practically the same. The cost of power at the Red Dog is 7.6c. per ton, against 5.8c. per ton at the Providence, which shows a saving of 20 per cent. in favor of the type of steam plant employed at that mine.

The Majestic mine represents one of the oldest types of steam plant and mill handling sheet-ground. Its high cost is due partly to its poorer equipment in engines, neglect of boilers, as well as the natural increased cost due to reduced tonnage, and the scale-producing mine water used in the boilers. The cost of power is 10c. per ton, about the same as that of the electrically equipped mill of the Eleven O'Clock of the same capacity.

Oil at 2½c. per gal., when used as an auxiliary to gas under boilers to do the same work, costs about 50 per cent. more than gas. Comparatively few mining plants use coal in preference to gas. The Federal mine at Aurora, handling about 160 tons per day, employing four machine drills and handling about 250 gal. per min., and firing three boilers of an aggregate capacity of 220 h.p., showed an average cost for fuel of 10.5 cents. This plant corresponds closely in capacity and type to the Majestic, which has gas-fired boilers, and the Eleven O'Clock, which has an electric plant, all showing approximately the same cost for power, 10.5c. per ton.

With slack at $1.40 or mine-run at $2 per ton, coal costs about the same as gas at 10c. per 1000 cu.ft., but the general inconvenience of handling, the dirt, and the extra labor connected with each firing account for the popularity of gas, even when the cost may be less favorable.

Gas Engines

The Little Princess mine is a representative of gas-engine power plant. Its position near the Providence and Red Dog, and its nearly equal capacity, and similar mining, milling and hoisting conditions, make it a most proper subject for comparison. The mill handles about 350 tons per day or at the rate of 20 tons per hour. It is driven by a tandem Snow gas engine of 110 rated h.p. The belt-driven Ingersoll compressor of 1000 ft. capacity, carries nearly the equivalent of 10 drills, the blacksmith shop being also supplied with air. A 100-h.p. boiler, gas-fired, supplies the steam for three 8x8-in. hoists, the light plant and what little pumping is necessary.

The gas under the boilers, required to do this work, is supplied at a cost of $4.25 per day. The mill gas engine, developing at least 85 h.p., consumes about $2.75 worth of gas in 17 hours. Power to drive 10 air drills costs $2.50 per day of eight hours, or 25c. per day for each drill. The average cost per working day handling 350 tons is below $10, or 28c. per ton. Adding one cent per ton for the cost of pumping, not included in the duties of the Princess power plant, we have a power cost of 3.8c. per ton against 5.8c. per ton for steam, and 10c. per ton for the electrical plant. An estimate of the first cost of a 300-ton plant is given in an accompanying table.

FIRST COST OF POWER PLANT FOR A 300-TON MILL.

Gas Engine Plant:	
Gas engine for mill (brake load, 125 h.p.; rated 150 h.p.)	$3200
Clutch for same	85
Gas engine for compressor (load 150 h.p.)	4500
Belt-driven air compressor (2 stage, 900 ft. per min.)	2750
Belt for compressor	250
Boiler (100 h.p., installed)	1000
Feed pump	90
Circulation water pump, fittings, covering, etc	500
Mine pump, capacity 500 gal., 220 head, with column pipe, etc	950
Three 8x8-in. Sampson geared hoists	750
Setting of gas engine plant	200
Light generator, 10 kw	300
Total	$14,575
Steam Plant:	
Two 150-H.P. high-pressure boilers	$2800
Feed-water pumps	180
Heater	200
Condenser	200
Semi-Corliss mill engine	1200
Air compressor, 900 ft., compound air and Corliss compound steam	4100
Two 8x8-in. Sampson geared hoists	750
Light generator, 10 kw	300
Mine pump, capacity 500 gal., 220 ft. head	700
Column pipe and exhaust line	250
Steam, water and exhaust lines	750
Asbestos covering	250
Deep well plant	2500
Extra buildings for boilers	600
Setting of engines	125
Total	$14,905
Electric Plant:	
Mill motor, 125 h.p	$1500
Clutch	85
Compressor motor, 125 h.p	1800
Belt	250
Compound air compressor, belt-driven	2750
Three 30-h.p. geared hoists	1125
Motor for mine pump, 75 h.p., 220 volts	1750
Centrifugal pump, 500 gal., 220 ft	850
Switch board	350
Wiring, lights, etc	750
Setting of motors	75
Transformer for hoist, pump and lights	800
Total	$12,085

Comparison of Costs

The cost of a gas-engine power plant is estimated at $14,575. This sum would furnish the necessary 100-h.p. boiler, three 8x8-in. geared hoists connected with the boiler, a mine pump of a capacity of 500 gal. against a 220-ft. head, an electric light plant, a standard belt-driven air compressor of 900 ft. capacity, a gas engine for the mill with a brake load of 125 h.p., one for the compressor of 150 h.p., and the whole plant set up in running order, the gas engines to be of a reliable make of neither the least nor the most expensive type on the market.

The cost of a steam plant of the best type to do the same work is estimated at $14,905. This includes two 150-h.p. high-pressure boilers, feed-water heater, condensers, pumps, semi-Corliss mill engine, Corliss air compressor and units for the

production of the power for hoisting, lighting and pumping. It includes the cost of steam-pipe covering, extra buildings required by the presence of boilers, and a deep well which is now considered essential in the district for boiler water.. The estimate is given in an accompanying table. The cost of a steam plant of the common type, i.e., one with slide-valve non-condensing engines, open-box feed-water heater, without the light plant, but of the same capacity, and all the essential points enumerated would be about $2000 less, or $12,900.

ing, with gas at 10c. per 1000 cu.ft. or coal at $2 per ton, shows a surprisingly close approach in expense to a gas-engine plant with gas at 25c. per 1000 cu.ft. The steam plant as now usually installed, with its medley of single-acting and compound, condensing and non-condensing engines, competing with a gas-engine plant of the type used at the Little Princess shows a cost of 5.6c. per ton against 3.8c. per ton of rock, or an economy of approximately 33 per cent. in favor of the gas engines.

If the work of lighting, hoisting, and pumping makes up more than 33 per cent.

COMPARISON OF COSTS AND ECONOMY OF THREE TYPES.

	Electric.	Steam.	Steam.	Gas Engine With Steam Auxiliary.
First cost of installation	$12,085	$12,900	$14,905	$14,575
Cost of power per ton of rock	0.10	0.075	0.056	0.038
Revised cost of power per ton of rock	0.10	0.085	0.066	0.048
Cost of power per year, 300 days, 300 tons	9,000	7,650	5,850	4,320
Saving by use of gas engine plant	4,680	3,330	1,530	

The cost per ton of rock is increased one cent per ton in the case of steam and gas engine plants by the necessity of having a day engineer in attendance. An electrical plant under intelligent management requires no engineer. An engineer's wage, $3 per day, would increase the cost one cent per ton for a 300-ton plant.

Reliability of the Gas Engine

The reliability in continuous service for steam and electric service is about the same. The majority of the users of gas engines, after their preliminary trouble due to inexperience, receive satisfactory service. The chief causes of gas-engine difficulties have been: (1) in the insufficient reserve horse-power usually installed, a gas engine being able to carry only a small overload; (2) too small and poorly built foundations, a gas engine apparently calling for two to three times the weight of a steam-engine foundation. When the engineer learns that a gas engine is bound to go, if it receives its spark and the correct mixture of air and gas, his troubles are as few as those of a steam engineer; but a gas engine does call for intelligent care in spite of all claims to the contrary. The Little Princess mine is here given not as an example of a smooth-running gas-engine plant, but it was selected because its operation could easily be compared with neighboring steam and electrical plants operated under similar conditions.

The employment of gas engines of an aggregate capacity of more than 5000 h.p. in the district by more than 100 owners of mills, foundries, laundries, and light plants, is pretty fair proof that a large number of engineers consider the gas engine a reliable prime mover. The economy of gas engines as compared with electric motors and steam engines is particularly apparent in small individual units.

In large steam plants of the best type, running wholly compound and condensing, of the total, it would be advisable to figure on a larger or double-compressor installation, cutting off the steam boiler altogether, and to do this very un-economical work by means of gas engines as prime movers, returning the air used to the intake of the compressor, and realizing a nearly maximum attainable efficiency.

Cost of Lead Mining and Smelting in Spain

Special Correspondence

The report of the Linares Lead Mining Company, Ltd., for the year ending June 30, 1907, gives some interesting information as to the cost of producing lead in Spain. The general characteristics of that company's operations are as follows: Working on a small scale; careful selective mining; hand-dressing to a high-grade product; smelting in reverberatory furnaces. The country is granite, the veins are narrow, exceedingly pockety, and are badly dislocated. A large amount of exploratory work has to be done and reserves are rapidly consumed. The company has two mines, the Pozo Ancho and Los Quinientos; the latter has much the poorer ore and its operating expense is augmented by the necessity for pumping. Operations at the two mines are therefore described separately.

Pozo Ancho Mine

The shaft of this mine is 1718 ft. deep. During the year under review, 4654 ft. of development, of which levels constituted the larger part, was done at a cost of $8.41 per ft. Where the pay streak was found at all, it ranged from ½ to 2 tons of mineral to the square fathom of lode. Machine drills were used for drifting; stoping was done by hand. Ore reserves at the end of the year included 3159 tons unbroken and 370 tons broken and lying on the stulls. During the year, 6576 sq.m. of lode were stoped, at an average cost of $4 per sq.m. These stopes, including the ore secured during drifting, yielded 27,848 tons of ore, the mining of which cost $3.82 per ton, equivalent to $37.32 per ton of finished product.

The 27,848 tons of ore were treated on the dressing floor at a cost of 47c. per ton, and yielded 2571 tons of first-class and 274 tons of second-class ore, the cost thus being eqivalent to $4.60 per ton of clean ore. The crude ore yielded 10.21 per cent. of clean ore, or 1 ton for each 9.8 tons of crude. The total cost was thus $41.92 per ton of clean ore.

Los Quinientos Mine

The shaft of this mine is 1670 ft. deep. During the year 2783 ft. of development, of which levels and crosscuts constituted the larger part, was done at a cost of $10.90 per ft. The pay streak in this mine did not carry anywhere more than 1 ton of mineral to the square fathom. Reserves at the end of the year included 747 tons unbroken and 172 ton of broken ore.

In the year, 5907 sq.m. of lode were stoped, at an average cost of $4.47 per sq.m. The stopes yielded 21,550 tons of crude ore, costing $4.19 per ton, equivalent to $67.21 per ton of clean ore.

The 21,550 tons of crude ore were treated on the dressing floor at a cost of 37c. per ton, and yielded 1234 tons of first-class and 72 tons of second-class ore, the cost thus being equivalent to $5.92 per ton of clean ore. The crude yielded 6.06 per cent. of clean ore, or 1 ton to each 16.5 tons of crude. The total cost was thus $73.13 per ton of clean ore.

Smelting

The larger part of the ore is smelted in a reverberatory furnace, with coal for fuel; the rest of it is calcined and then smelted in a blast furnace together with slags and fume obtained from the reverberatory furnace, and dross from the desilverizing pots.

The amount of ore treated in the reverberatory was 5389 tons, averaging 77.12 per cent. lead. The recovery amounted to 3485 tons of pure lead, a recovery of 83.84 per cent. of the lead in the ore. The slags and fumes from the operation contained 443 tons of lead which, added to the metal recovery, accounts for 94.50 per cent. of the lead in the ore. The coal consumption was 5389 tons, costing $13,631, or $2.53 per ton of ore smelted.

The amount of ore calcined was 499 tons. The blast-furnace yield comprised 257 tons from the calcined ore, 525 tons from slags and fumes, and 31 tons from dross slags. The total weight of lead treated in the desilverizing pots was 4370 tons, which yielded 488 tons of concentrated or R. R. lead, 3392 tons of reduced, or F. O. lead, 425 tons of refined or D. lead, the remainder being lost or contained in dross.

Suggested Mining Method for Pittsburg Seam

A New Plan for Mining the Pittsburg No. 8 Bed by Which Greater Safety May Be Attained and Losses of Coal Reduced 30 Per Cent.

BY R. Y. WILLIAMS*

The present method of mining the Pittsburg No. 8 seam in Belmont and Jefferson counties, Ohio, and in the Panhandle district of West Virginia is both wasteful of the coal and uneconomical. The seam lies practically flat under a normal cover of approximately 225 ft.; the bed averages 5 ft. 6 in. in thickness. The analysis of the coal shows the following:

Moisture	00.93 per cent.
Volatile matter	39.46 per cent.
Fixed carbon	51.35 per cent.
Ash	8.26 per cent.
	100.00 per cent.
Sulphur	3.86 per cent
Phosphorus	0.0067 per cent.
B.t.u.	13,949

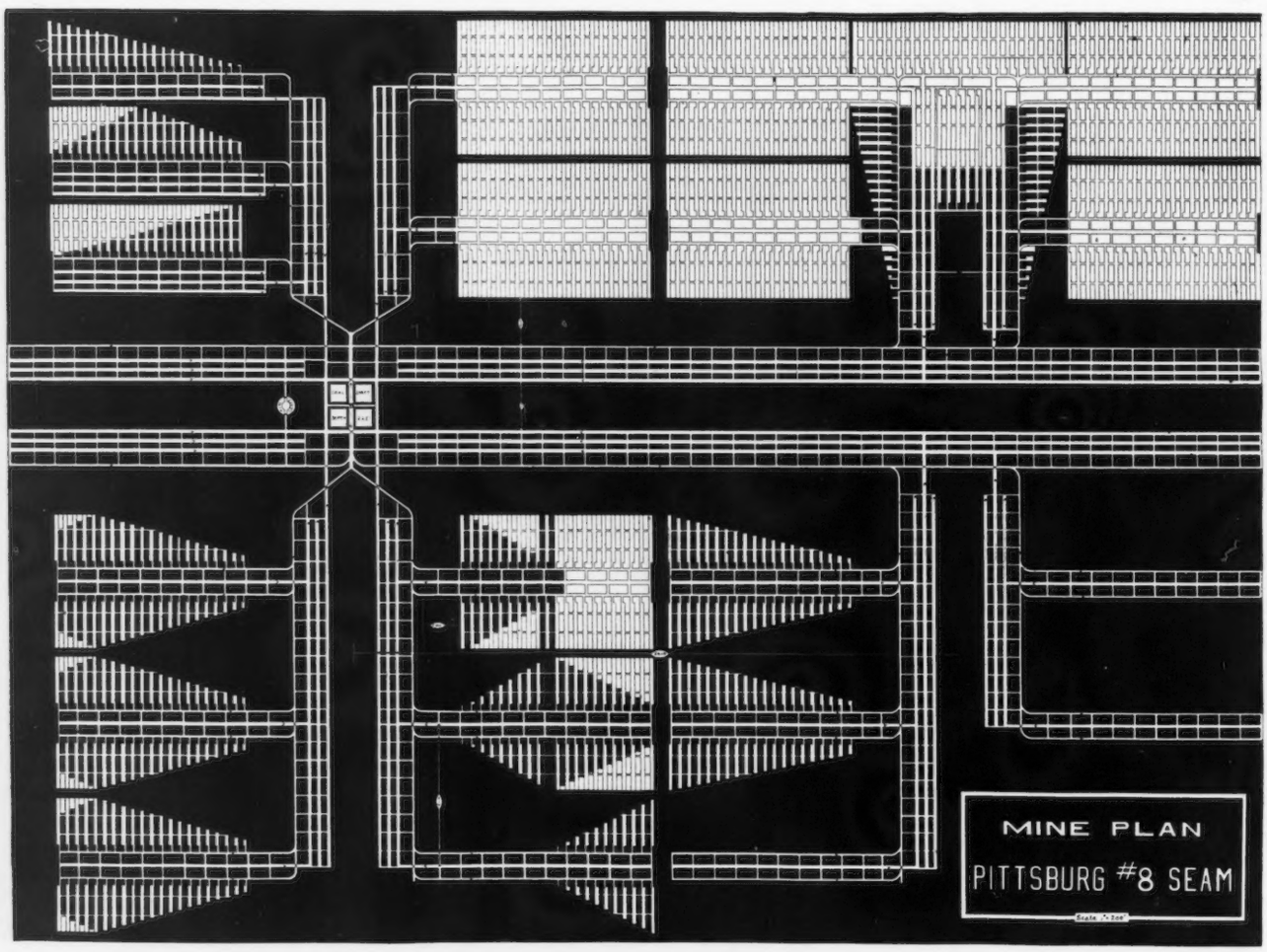
The following figures show the total tonnage in bituminous coal in Belmont and Jefferson counties, Ohio, and also the annual increase in percentage:

Years.	Tonnage.	Percentage.
1900	2,455,870	152.3
1901	2,829,163	176.0
1902	3,810,757	237.1
1903	5,205,060	323.3
1904	5,588,472	347.1
1905	7,209,645	448.6
1906	7,465,571	464.6
1907	11,003,845	684.8

A section of the Pittsburg seam and adjoining strata is as follows:

Limestone	20 ft. to 40 ft.
Shale	5 ft. to 6 ft.
Roof coal	12 in. to 18 in.
Soapstone	1 in. to 10 in.
Pittsburg coal	62 in. to 68 in.
Fireclay	1 ft. to 3 ft.
Limestone	Bottom.

The mining plan generally adopted throughout this region drives two parallel main entries on the butts of the coal through the center of the property, and from these main headings, two parallel face entries are driven at 2000-ft. intervals; one of the latter entries is used for haulage and the other for air. These entries are 8 ft. wide and are laid off on 40-ft. centers. At each 500-ft. interval along the face entries, a pair of butt or work headings lead off both to the right and to the left, usually at 90 deg. to the main entries. From each work heading, 20 to 30 rooms are driven on the face of the coal. These rooms are spaced on 32-ft. centers, are 24 ft. wide, 225 ft. deep and have the roadway up the center. Under these conditions, with the room pillars only 8 ft. through, no attempt is, or could be, made to do any stumping in this coal.



GENERAL SYSTEM OF DEVELOPMENT FOR THE PITTSBURG SEAM IN EASTERN OHIO AND NORTHERN WEST VIRGINIA

Great Losses of Coal

Obviously, this system is wasteful of

*Mining engineer, Moundsville, West Virginia.

the coal, and the operator who chooses to work his property in this way lets it be known that his aim is to extract but 56 per cent. of the total tonnage he owns. This method is so crude, however, that the element of luck is never strong enough to prevent the heaves and squeezes which this system invites. I venture the assertion from my own observation that not more than 40 per cent. of this coal is being mined per acre. This is a direct loss to the resources of the United States.

The United Mine Workers of America, as well as the operators, are responsible for this state of affairs. The Union lays down the rule that all rooms shall be 24 ft. wide, and that heading yardage shall be paid where the mine boss orders a room driven less than 24 ft. This has been the custom for years, and no concerted action on the part of the operators has ever been made in order to bring about an improvement in the mining conditions. When the question is asked as to why pillars are not robbed, the reply is to the effect that the Pittsburg No. 8 seam cannot be stumped.

I have been in close touch with the mining conditions in this part of the country, having been superintendent of a mine typical of this section where I had an excellent opportunity to study all the details of the working of the system, including squeezes and the conditions resulting therefrom. I submit, therefore, the following method which I believe to be peculiarly adaptable to the locality in question. The accompanying illustration illustrates the method.

A Proposed System of Working

The main features differentiating this new plan of working the coal from the old scheme are: (a) the increasing of the room pillars from 8 ft. to 22 ft. and the decreasing of the room widths from 24 ft. to 18 ft., also placing the roadway on one rib; (b) the leaving of heavy chain pillars both to protect the main haulageways from the action of the heavy limestone above the coal, and to prevent the oxidation of the coal left in the pillars; (c) the introduction of six room air courses between the main entries, and from one to three room air courses between each pair of butt headings, to make possible an excellent and inexpensive system of return air; (d) the splitting up of the intake air and the return of the vitiated air in a manner that will reduce to a minimum the chance for the ignition of firedamp mixtures.

The details of this plan may be tabulated as follows:

Face entry interval	2,610 ft.
Butt heading interval	600 ft.
Main entry pillars	200 ft.
Butt heading pillars	30 ft.
Room pillars	22 ft.
Room centers	40 ft.
Crosscut centers	80 ft.
Width of rooms and room air courses	18 ft.
Length of rooms	225 ft.
Length of room necks	21 ft.
Width of headings and crosscuts	8 ft.

No passways are indicated on the drawing as their location depends on the particular system of haulage used, and on roof and gradient conditions.

A Large Percentage of Coal Obtained

In studying this new method, the first fact noticeable is that almost all the coal is obtainable. We will assume, however, that the actual mining wins but 90 per cent. As the old system recovers only 40 per cent. of the seam, the new plan effects a saving of 50 per cent., or exactly one-half the property. Where coal is valued at $150 per acre, and assuming a coal proposition controlling 1000 acres, the proposed plan of working the seam will eventually mean a saving of $75,000. These figures applied to the "cost per ton" basis shows a saving of $0.01875, or nearly 2c. per ton.

The second advantage which this system offers is the reduction in the cost of yardage, both per ton of coal produced and per acre developed. Let us assume a body of coal measuring 2610 ft. on the butts and 3200 ft. on the face:

(a) Mining on the old plan, we have the following:

Main entries	3,200 yd.
Main entry crosscuts	800 yd.
Butt headings	9,720 yd.
Butt heading crosscuts	2,400 yd.
Room necks	5,796 yd.
Room crosscuts	4,224 yd
Development headings	1,740 yd.
Development heading crosscuts	440 yd.
Total yardage	23,320 yd.

Theoretical area of coal removed:

Wide work (24 ft.)	4,053,888 sq.ft.
Narrow work (8 ft.)	679,680 sq.ft.
Total	4,733,568 sq.ft.
Total area in block	8,352,000 sq.ft.
Theoretical percentage removed	56 per cent.
Actual area of coal removed	3,340,800 sq.ft.
Actual percentage removed	40 per cent.

The following conditions obtain:

Pick yardage	$1.66
Machine yardage	0.52
Thickness of seam	66 in.

One ton of coal in solid equals 30 cu.ft.

In the area considered, the following will be true:

Total tonnage	1,531,200 tons.
Tonnage theoretically possible	857,472 tons.
Tonnage actually gained, 40 per cent	612,480 tons.
Yardage, total cost by pickwork	$47,011.20
Yardage, total cost by machine-work	14,726.40
Yardage, theoretical cost per ton, pickwork	0.055
Yardage, theoretical cost per ton machine-work	0.017
Yardage, actual cost per ton pickwork	0.077
Yardage, actual cost per ton machine-work	0.024

(b) By the new method here suggested, we note the following figures:

Main entries	2,000 yd.
Main entry crosscuts	2,193 yd.
Butt headings	6,787 yd.
Butt heading crosscuts	2,640 yd.
Room necks	2,800 yd.
Room crosscuts	5,280 yd.
Development headings	870 yd.
Development heading crosscuts	924 yd.
Total yardage	23,494 yd.

With conditions as to yardage costs, area, etc., the same as above, we find the following to be true:

Total tonnage	1,531,200 tons.
Tonnage actually mined (90 per cent.)	1,378,080 tons.
Yardage, total cost by pickwork	$39,000.04
Yardage, total cost by machine-work	12,216.88
Yardage, actual cost per ton pickwork	0.0283
Yardage, actual cost per ton machine work	0.0088

A comparison of the two methods with respect to yardage shows the following:

	Old.	New.	Saving.
Yardage, cost per ton, pick	0.077	0.0283	0.0487
Yardage, cost per ton, machine	0.024	0.0088	0.0152
Yardage, cost per 1,000 tons, pick	77.00	28.30	48.70
Yardage, cost per 1,000 tons, machine	24.00	8.80	15.20

It is also important to note from the above considerations that the cost of the total yardage required by the proposed plan is $40 per acre less than under the old system.

Speed of Development

Quick returns for money invested are required of all systems of coal mining; but the business of producing coal should by this time be well enough understood to prevent the demands of the investors from ruining the mine by "hogging the coal" at the foot of the shaft.

The system here presented, as compared with the method usually adopted, offers an advantage in the matter of getting up a quick tonnage by its plan of driving 20 four-room air courses comparatively near the shaft, and yet so located that the removal of the coal in these rooms cannot possibly impair the solidarity of the shaft pillars. Moreover, this wide work will materially lower the cost of the coal in this early development stage when as is customary, most of the coal is won from narrow workings.

In the matter of ventilation, the proposed method has many points of advantage. If we assume the mine in question to be dusty, gaseous and ventilated by a fan working as an exhaust, the first noticeable feature is that each work entry is ventilated by a fresh split of air, (a condition that will eventually be required by law). In the second place, firedamp mixtures of gas and dust, which are generated mostly at the working faces, are at once removed from places where they are an element of danger and deposited in the return air courses. Furthermore, by increasing the area of the return air courses, the velocity of the return air is greatly diminished; this means an enormous decrease in the power on the air according to the formula

$$u \text{ equals } Ksv^3.$$

Where u equals power on the air.
K equals coefficient of friction.
s rubbing surface.
v equals velocity of the air.

It is not claimed that this system will reduce the item of ventilation cost, but it

is maintained that with the same horsepower on the fan, the efficiency of the ventilation will be more than doubled.

Maintenance and Timbering

Maintenance and timbering in a mine operated along the lines suggested in the accompanying drawing are relatively simple and inexpensive when compared with the old methods. It is an evident fact that the cost of maintenance of tracks, mining machine equipment, etc., for any mine will be materially lowered if a system be introduced which will raise the percentage of coal obtained from 40 to 90 per cent. In addition, the expensive deadwork required to keep narrow air courses clean is entirely eliminated. Where a fall occurs in narrow workings, the passageway is choked, while in a wide air course falls may take place and continue even to the limestone above the coal without seriously impairing the ventilation.

Under the old regime, from 200 to 300 props were required per room. These props are worth from 6 to 12c. at the mine; therefore, the 200 posts required in one room at 10c. each will cost $20, or about 2c. per ton, not including the cost of delivering the posts to the working faces. Moreover, these posts are not recovered. Under the new scheme, if the conditions are similar, 100 posts will work the room and rob the pillar, and most of these props are recoverable. Under this latter arrangement, steel posts could be used to good advantage, and should reduce the cost of timbering to less than ¼c. per ton.

Another advantage that this plan offers lies in the possibility of rapidly, cheaply and completely sealing off any portion of the mine should dangerous gases or water collect in old workings. Situations often arise in old mines where an opportunity of this kind would be worth hundreds of dollars.

The plan of isolating the various sections of the mine in the manner this system suggests, makes it appear impossible for an explosion to occur in any one division of the workings and wreck the whole mine, as would be the case were all the entries and rooms directly connected. If this method will thus reduce the area contributing to an explosion, and will thereby limit the explosive violence to the division in which the ignition occurs, the advantage accruing from the adoption of the plan is incalculable.

In recapitulating the above benefits to be derived from the use of the proposed system, the following "cost per ton" summary shows the saving in working costs:

Saving in original property cost.	1.875c. per ton.
Saving in yardage in pick mines	4.870c. per ton.
Saving in yardage in machine mines	1.520c. per ton.
Saving in maintenance and timbering	4.000c. per ton.
Total saving in pick mines	10.745c. per ton.
Total saving in machine mines	7.395c. per ton.

The following summary shows as marked advantages as the above, but advantages cannot be readily reduced to the "cost per ton" basis:

1. Increased ventilating efficiency.
2. Reasonable speed of early development.
3. Protected main haulageways.
4. Reduced likelihood of explosions.
5. Limited area for spread of explosions.
6. Easily sealed abandoned workings.

The Pittsburg No. 8 seam is now valued at $150 per acre. It may confidently be predicted that these figures will soar higher when the proposed improvements in the navigation of the Ohio shall have been consummated and the Panama canal completed. Considerations of this character, when combined with the statements of Prof. I. C. White relative to the wasting of our natural resources, should awaken in the operators of this region an earnest desire for a mining system that will yield a larger return per acre.

Notes on Recent Mine Disasters

By James Ashworth*

The disaster at the Darr mine on Dec. 19 last, whereby 233 valuable lives were sacrificed, following so quickly after the Monongah mine explosion, which caused the loss of nearly 400 lives only 13 days previously, cannot have failed to cause a feeling of nervousness throughout the coalfields of the United States. Not only are such great accidents naturally calculated to cause a feeling of apprehension, but they also cause every thinking owner and manager to look around and consider the condition of their immediate properties.

That blasting is the greatest factor of danger and uncertainty is most distinctly indicated by the Monongah explosion, if it is not so certainly indicated in that occurring at Darr. At Monongah, only blasting powder was used, but at Darr, dynamite was also employed. Whatever explosive was in use in either mine, it is perfectly clear that explosives were applied with an amount of recklessness which is simply appalling. In the majority of cases the shot holes were drilled on the solid, and, therefore, it was totally impossible for these shots to clear themselves to the foot of the hole. This sort of blasting is of no advantage to either the workmen or the owners, as the percentage of run-of-mine is largely increased, and the product of the shot is less speedily loaded with the shovel than it would be if handled in blocks; furthermore, a mine car will not carry so large a weight of run-of-mine as it will of blocks, and though this may seem a small matter at first sight, yet when looked at through the figures of a whole day's output, the total may be greatly affected. One of the reports on Monongah suggested that the weight of powder in each shot should be reduced, and that the coal should be blasted down in two benches; there is little doubt but that if the coal were broken down twice, the advantage would be marked, as the coal dislodged by the roof shots would be in a large marketable condition, and the tonnage of coal secured per pound of explosive would be increased.

The coal may not in all cases be thick enough to make it worth while to shoot it down in two lifts, but if not, the holes may be multiplied and a shot fired in each corner of a room, after which a center shot will bring down the remainder in fine condition. The writer has in mind a mine where dangerous conditions were frequently encountered through placing two heavy shots in the wall of coal, but when these were multiplied into three shots, all fired separately, the dangerous conditions were immediately disposed of, and better results were obtained.

More thorough supervision is insisted on by all the inspectors of mines, and this again is a point of the greatest value to the safety of the mine; but under no conditions whatever should a fire boss or shot firer be allowed to fire a hole which he has not examined before it is charged, for if the workman is permitted to charge the hole, and simply leave it ready for the shotman to light, the latter can only give the minimum of protection to either himself, the mine, or the rest of the miners.

Watering

Next comes the question of watering, which in the majority of cases is, and always will be, of a more or less perfunctory character. Mining men often forget that coal dust is not an easy article to dampen, and that to properly "water," only a small working place takes much more water than can be applied in practice. In one case it was suggested that the weight of water used should be equal to half that of the dust, but this method of reasoning is not practical, nor would it be effectual, and, therefore, something more than that is required.

Methods Tending to Greater Safety

I would suggest that a wet blanket, or other suitable material be hung up, not necessarily the whole hight of the coal but particularly close to the roof, and at such a distance from the shot that it could not be torn to rags by the dismembered coal. Every hole should be bored by a twist drill, as the screwed cut, left inside the shot hole by these drills is of the greatest assistance in holding the stemming, which ought to be of a non-inflammable nature. The use of electricity for shot firing would probably facilitate the work of the shotmen, and be of considerable advantage in gaseous mines. There is, however, another point which if taken into account in the laying out of the mine, would have the most important influence on the gen-

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eral safety, viz., the longwall method of working coal instead of the pillar-and-stall or stoop-and-room. There are many varieties of longwall, and if one system does not suit the conditions, some slight modification will certainly do so.

A longwall mine is more easily ventilated than one on the stoop-and-room principle, and the weight of the roof comes into use just where it is required, that is to say, on the coal face, where it will in many cases bring down the coal when properly undercut without the use of powder. Furthermore, the roof weight instead of crushing the coal pillars settles down on the pack walls. Many miners have the strongest objection to the use of high explosives because the latter do not bring down the coal in as good condition as black powder, but even this difficulty is of easy solution if a special powder known in England as Bobbinite is used. This powder has a similar appearance to blasting powder, but the flame if such it can be called, is of an entirely different character. It is fired with ordinary fuse and does not require a detonator; therefore, it does not introduce this most serious objection to the use of high explosives. Detonators are apt to get dropped in the workings, and in cases of misfires to cause accidents both within the mine and outside it.

Blasting In Mines

Still another serious danger from blasting in mines is called by some observers, "detonation," and by others as "percussion" or concussion. On no previous occasion has this phenomenon of coal-mine explosions been so clearly demonstrated as in the Monongah mine, where various experts distinctly showed that the disaster was extended throughout Nos. 6 and 8 mines by this agency. Therefore, any explosive which requires a detonator, also introduces a danger factor into the mine which did not exist before, and this is of the greatest importance in any mine producing firedamp, for without the addition of firedamp, detonation would not be possible. Detonation also affects the safety of a mine where watering or spraying is depended on as one of the factors of safety, because no watering can influence a detonating vibration, and if it does it will assist in carrying it out more effectually.

The Effect of Detonation

A demonstration of detonation was recently in evidence at the Urpeth explosion, in the county Durham, England, where two shots of a high explosive were fired in a heading, the one after the other; neither blew out and there was no visible explanation why an explosion had been caused; it was, however, known that there was some gas in the air when the first shot was fired, and it was surmised that this shot released more gas. Both shots were fired electrically, and I believe that the second shot detonated the gas in that part of the mine and killed all the men who were at work there. The Udston explosion in Scotland and the Universal explosion in South Wales, were instances of the effects of "percussion" or in the latter case of "detonation," there being simultaneous explosions in widely separated parts of the mines, at practically the same instant of time. In the case of Monongah, there is no public report of the doctors on the state of the bodies, or of the cause of death, but I have been informed that most of the bodies were badly mutilated by the direct effects of the explosion, or by the enormous pressure (percussion), which in the majority of cases pressed the ribs inward and in other cases, disembowelled the bodies. This latter would result from the after effects, when the gases created by the explosion cooled down, and condensation then caused what is generally described as backlash, or that period when air rushes into the mine at enormous velocity to fill the void caused by cooling and condensation.

Whether the Darr mine disaster was caused by a blown out or over-powdered shot, or whether it was caused by the ignition of firedamp through the recklessness of men who only wished to save a couple of cars of coal from being buried by a fall of roof, and for this purpose passed a danger board with a naked light, does not matter much, but it demonstrates the fact that where more than one place can be confidently pointed out as the initial point of an explosion, that either percussive or detonative, or other simultaneous effects have been factors in the disaster.

Believing, therefore, that either percussion or detonation have been clearly demonstrated in the cases of two recent explosions, I will consider what is the best remedy. A few years ago the division of mines into separate ventilation districts and the subdivision of these districts into separate panels, would have been a perfectly certain guard and security against any such effects, but the accidents at Monongah and Darr, without including any others, make it clear that these precautions, admirable though they be, are insufficient, and we are forced back to the very first principles of mining, which are, that an adequate volume of air must be provided to render innocuous all firedamp given off by the mine, and that we must not be satisfied by providing just a fixed number of cubic feet of air per man and animal, but that the volume of air provided shall efficiently sweep the working faces of the mine; that regulations for the safety of the mines and miners shall be carried out with greater strictness, and discipline maintained; that safety lamps of the best construction giving not less than one standard sperm candle-light be used in all mines where firedamp is continuously given off; that the use of electrical wires "overhead" on the roadways shall be carefully considered, and although it was not shown by the evidence given at either Monongah or Darr that electricity had any part in extending or initiating either explosion, yet where the products of an explosion are being forced through a mine at a high velocity, it is conceivable that the wires may be broken down, and an arc caused by the short-circuiting of the current, thus igniting a mixture of air and carbon monoxide which otherwise might have passed to the outside of the mine without ignition.

Coal dust is stated to be the important factor in both the explosions referred to, and the chain coal cutters are the producers of excessive quantities of dust; however, the experiments made by Mr. Jones, of the Westmoreland Coal Company, Irwin, Penn., demonstrated that the chain machines made far less dust when at work than did the punchers or hand mining; if, however, the comparison is made in the very fine dust only, then the chain made a little more dust than hand mining, but far less than the puncher, and, therefore, if a chain machine were worked at an equal speed to hand mining, doubtless the machine would make the least dust. We live in an age of hustle, and, therefore, if large outputs of coal are to be made and mines developed with vigor, it is perfectly certain that machinery will have to be applied wherever it is possible to apply it, and, therefore, dust will be a troublesome factor to the end of the chapter, and its presence must be to some extent tolerated while its production may be restricted by improved methods of mining; for instance, by working the coal cutters on a separate shift, and periodical removals of dust. The most dangerous dust is that which for a certain period after it is freshly produced from the coal, floats away in the air current, supported by the gas which is occluded within its minute body, and which apparently makes it so greasy that water will not adhere to it, and consequently, the watering and spraying of a mine exercises no influence on this class of dust, but only on the heavier particles which take a minor part in colliery explosions and mainly assist in the production of carbon monoxide by the effect of heat on their surfaces.

If close attention is given to the provision of an ample ventilating current, the restriction of blasting, and the use of the best safety lamps, it will be found that these are better remedies for colliery explosions than attempts to control the demon of coal dust by watering or spraying.

Too strong a ventilation dries the air and increases the danger of explosions. The best ventilated mine is sometimes the most perilous. This was proved by the Courrieres disaster, the Courrieres mine being one of the best ventilated in Europe.

Colliery Notes

Great Britain has one mine inspector to every 22,000 persons employed.

An authority on hoisting states that the best composition for dressing winding ropes is plumbago or graphite mixed with vaseline, linseed oil, palm or other vegetable oil.

Tests made by the Transvaal Commission showed that there is often a difference of from 3 to 16 per cent. between the aggregate strength of the wires of a hoisting rope and the breaking load of the rope.

Every 10 deg. rise in temperature of feed water may be taken as effecting a 1-per cent. saving in fuel, and as the carbonates are driven off at 200 deg. F., the saving in fuel due to heating with exhaust steam is important.

More than 100 tons of coal are being taken from the Susquehanna river daily in the vicinity of Espy, Penn. Five dredges are being operated at that point. Many families in that section secure their winter's coal from the river.

During the year 1907 the Maxwell mine of the Lehigh & Wilkes Barre Coal Company produced 310,845 tons of coal with only one fatal accident. The Hollenback colliery of the same company produced 296,188 tons, and had but one fatal accident.

In order to reduce friction and avoid accidents on a main-rope haulage system, vertical pulleys and rollers set on end should be used to take the rope around curves; if the curve is sharp, guiding boards inside the curve will help to keep the trip on the road.

The following ingredients make a good rope lubricant; tar, oil, mica, and axle grease. The tar and oil should be absolutely free from acid of any kind. This lubricant resists water successfully, thoroughly penetrates the wires and fills the cable, giving it a solid appearance.

When preparing anthracite coal in a breaker the waste made by the rolls may be increased as much as 5 per cent. of the whole output by over-feeding the coal to the rolls. The size of the rolls also influences the amount of waste made. Large rolls are generally preferred by most superintendents.

The air space inside a mine motor should be reduced to a minimum, so that the cubical capacity and consequently the volume of explosive mixture that can collect in the motor will be as small as possible. If possible, all motors should be blown through once a day with compressed air to prevent the stopping of the openings by coal dust.

Tests have shown that the tension on single belts is nearly 45 lb. per in. of width, and from 60 to 80 lb. per in. on heavier belts. On a 10-in. double belt, therefore, the tension is equal to 700 lb. The loss of power, a large part of which is due to tight belting, is, in some plants, as high as 70 per cent. The slacker belts are run, the more power they will transmit.

The mining regulations of the Transvaal demand that a portion of a rope not shorter than half the circumference of the shaft head sheave, and cut off when recapping, be sent to the Government Mechanical Laboratory for testing. Not more than six months must elapse between successive recappings of round rope, and three months in the case of flat ropes.

Pulsometers work best and give the greatest efficiency when the hight to which the water is to be raised is between 30 and 50 ft. They are best adapted for the drainage of dip workings, or for use in sinking shafts. They also give satisfactory results when gritty water has to be dealt with. Difficulty is often experienced from the ball valve getting worn flat and sticking.

Even when electric motors are entirely inclosed and so-called explosion-proof, every possible care must be taken; this means frequent overhauling, frequent cleaning and a competent and intelligent attendant. An inclosed motor is likely to draw in gas and air, especially if the bearings become worn; this is due to the partial vacuum in the motor case when the machine cools down after use.

The wear of a rope increases as the speed. Double the speed and you double the amount of wear. The load may, however, in most cases be increased without any harm being done. It is better to increase the load than the speed. These points should be borne in mind when considering the comparative merits of main, tail and endless rope haulage; they are also especially applicable to hoisting from deep shafts.

Insulating oil should be pure, unmixed, mineral oil obtained from fractional distillation from petroleum and not treated chemically in any way. It must contain no trace of either acid or alkali, and all moisture should be eliminated by heating carefully at about 268 deg. F. before using. For transformers, the oil should be fairly light in color and as fluid as possible; switch oil may be more viscous and darker. Cheap oil, which is apt to be more or less gritty, should never be used.

If possible, conduct all electric wires for mine lighting or machine operation through entries not used by men or beasts. Electric-haulage roads should never be used for traveling ways as the trolley wires used to supply the power to the locomotives cannot be insulated. At points where it is absolutely necessary for men to cross an electric-haulage road prominent danger signals should be set up. In gassy mines electric wiring should not be allowed beyond the main intake airway.

Whenever a fire occurs in a mine, it should be completely isolated by stoppings constructed at least 33 ft. from the nearest point of the fire. These stoppings should be built of brick or stone, or should be made of logs, one on top of the other, a double row 4 ft. apart, reaching from the floor to the roof. The logs should be let into the floor and the roof at least a foot and the ends into the sides of the pillars 18 in. The space between the two rows should be packed tightly with sand, ashes or clay. If brick or stone walls are used, they should be thick enough to resist the pressure of the superincumbent strata.

When a seam of coal is to be worked by the longwall system, the planes of cleat greatly influence the quality of the output. When "working on the face" the coal is easily won, but the face is bad to keep open. When "working on the rise," the roof has a tendency to fall away from the face, and to lie against the face when working to the dip. When "working on the end" the coal is hard to mine, but the roof at the face can be kept up better, although the coal is often crushed by the roof pressure. If the output is to be marketed as steam coal, this crushing of the coal is a serious drawback, but when the coal is intended for making coke, it is economical to have the face advancing on the end of the cleat.

In low seams of coal, the blasting of top and bottom rock to provide space for getting the cars up to the working face is avoided at some plants by the following method: A branch road is made to keep the cars off the heading road. Then use small, flat-wheeled cars for each chamber, so that they can be run on the bottom rock and thus do away with the use of tracks in the rooms. Keep the regular mine car on the branch and fill it from the small chamber cars, which should be equipped with a hook on one end of the haulage rope and a grip on the other end; this system is then operated as a gravity plane by the use of a prop, located at the chamber face, and fitted out with a pulley block for the rope to run on.

The Midland District Miners' Fatal Accident Relief Society of England is a splendid example of what organized thrift can do and what miners may accomplish for themselves if more effort is put into saving and less into demands for State and Federal aid. The membership of this society is nearly 40,000, and the amount standing to the credit of the benefit fund, the whole of which is available for the widows and orphans of members who lose their lives in the mines,, is approximately $300,000. The dues are 2c. per week per member, the benefits comprise annuities of 60c. a week, until the child is 13 years of age; funeral expenses are also paid. During its existence, the society has provided for 428 widows and 938 children at a cost of $330,000, besides paying $33,200 in funeral allowances and legacies to widows and other relatives of deceased members.

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Transvaal Gold Mining

Gold production in the Transvaal made a record in July, the total reported by cable being 584,455 oz. fine gold—or $12,080,685—which is 929 oz. more than was reported for last December, though the total for that month was swelled by the inclusion of a considerable quantity of gold reserved in previous months. For the seven months ended July 31 the total output was $82,357,796, indicating that the total for 1908 will be not far from $140,000,000, or far in advance of the other great gold-producing countries.

A year ago it was thought possible that the Transvaal had approached its probable maximum output, and there were not wanting prophets who predicted that a gradual decline would soon begin. That the decline will come some time is, of course, inevitable; but at present the time seems distant. There are, indeed, recent signs of a probable increase in production. Among these are the extension of the eastern limit of the Witwatersrand area, as mentioned in our pages last week. The main cause of the gain in production this year, however, seems to be the working of much low-grade ore, which has hitherto been sorted out or left in the stopes untouched. This has been made possible by the reduction in working costs, which has been a prominent feature of recent practice in the Transvaal. Whether this reduction can be carried much further is uncertain, though mine and mill managers are concentrating their attention on this special point, and much may be done when so many able and experienced men unite in the effort. There is a possible doubt on the point whether the working of so much low-grade ore will increase dividends; but there is no doubt that it is a factor in the increase of production.

The withdrawal of Chinese labor from the Transvaal mines, concerning which such gloomy predictions were made a year or two ago, has had no perceptible effect on production. Over two-thirds of the 40,000 Chinese laborers at one time employed have been sent home. Their places, however, have been readily filled by negroes, the supply of Kafir labor having been, for various reasons, more abundant than for several years past.

The Transvaal has some difficult economic problems to work out in the next few years; but it does not seem probable that in that time they will be complicated by any serious fall in the gold production.

The Alabama Coal Miners' Strike

The murderous attack on a train carrying strike-breaking miners near Birmingham is the first notable case of violence which has marked the present strike in the Alabama coal mines. Indeed it is the first instance of such an outbreak in the State which we can now recall. It indicates a change in mining conditions in that State, and the introduction of a new element.

For a number of years the coal mines of Alabama were operated on a sliding scale based on the price of pig iron, in the manufacture of which a large part of the output was used. About four years ago the United Mine Workers, having succeeded in unionizing a considerable number of the miners, declared a strike. The large iron companies, which operate the greater part of the mines, refused to accede to the demands of the strikers, and continued to operate their mines under the old scale. The companies were successful at that time, partly because they brought in a number of men from the outside; partly because the negro miners were hard to hold permanently to any organization, and partly because the companies were secure in the possession of a considerable reserve force in the shape of convicts, hired from the State under the Alabama penal system, who, of course, had no option in the matter. Since that time the mines of the iron companies have been operated on a non-union basis. Most of the commercial coal companies mining coal for sale, however, made terms with the union, and have since been operated with union men. The agreements of these companies expired July 1 and most of them decided to make a reduction in the mining scale. The union had previously been active in organizing all the miners it could reach, and refused to accept the proposed reduction of 10c. per ton in the mining scale, offering as a compromise a decrease of 2½c. only. This was rejected, and a strike was ordered.

The result was that nearly all the commercial mine operators decided to join the iron companies and work their mines on the open-shop plan. Although the number of strikers who joined in the movement planned by the union was lar-

ger than had been anticipated, nearly all the mines have continued in operation, and the production has been large enough to supply current demand. As requirements have been recently increasing, with an increase in iron output, it became necessary to bring in a number of men from outside the State, and it was a party of these men who suffered in the recent outbreak.

In the strike of three or four years ago very little violence was reported. That it has occurred now is due to the presence of a new element, consisting of the foreigners who were then brought in to take the place of the striking men, and who are leaders in the new strike. The negro miners are hardly prepared for open warfare, unless they have white leaders, and these seem to have come forward. The State, however, has taken active measures to suppress violence promptly.

The struggle in Alabama is to decide whether the union shall continue to exist. At present the advantage seems to be with the operators, largely for the reasons given for the failure of the former strike. By murder the strikers have put themselves at a disadvantage, and the operators have shown themselves ready to take the opportunity.

The National Conservation Commission

The National Conservation Commission, in its commendable search for information as to the extent of our natural resources, is sending out a schedule of questions for which it requests answers. A large part of these relate to forests, agricultural resources, etc.; those of interest to mining men are published on another page of this issue. We understand that the answers to these questions are to be used only in figuring up the aggregates which the commission desires to obtain approximately.

Some of these questions cover points to which answers will be exceedingly difficult to obtain. This is especially the case with those referring to the quantity of mineral resources unmined and the probable future supply. In the case of coal deposits and of some iron deposits approximations can be reached in many cases; but with other mineral deposits—which include metallic ores—we do not see how any reliable estimates can be obtained. In many cases mine-owners and operators would be relieved if they had the information for themselves, though they might not be always willing to give it to others. Comparatively few, even of the larger mines, have ore reserves blocked out or ascertained for a long period ahead. The probable life and future production of a great majority of metal mines are questions which future work must decide: they can be answered for a very few years only, under the best conditions. "The probable duration of the supply of each important mineral," which the commission seeks to ascertain, must be, at best, founded on estimates which are merely guesses at the truth—and in many cases very wide guesses.

The schedule of the commission contains, however, a number of questions which ought to bring valuable information and expressions of opinion. The proper collation and presentation of the answers, or their substance, should result in publications of value to the public.

The Prospector and His Motor Car

The automobile has made a place for itself in the mining industry. In Nevada the uses to which the gasolene-driven car has been put are endless, and it is only a question of time when some enterprising manufacturer will put upon the market a machine especially designed for the rough work of the prospector and miner. At present one sees luxuriously upholstered cars, built for pleasure touring on well made and well kept roads, loaded with tools and supplies, doing the work of the burro and the pack mule.

The advantages of a means of transportation that consumes nothing but gasoline and a little lubricating oil in a desert country is obvious. Pack-trains are slow at best, and prospecting is not the leisurely business it once was. The news of a new strike now travels rapidly, and against the man with a swift motor car to carry him to the new camp the old-time prospector with his burros has no chance whatever. All the desirable locations will have been staked out while the pack-train is still crawling across the desert miles away.

A prospector who recently covered 6000 miles during a six months' trip in Nevada predicts that the automobile will supplant all other means of transportation in certain sections of mining country, in spite of the difficulties to be overcome. Difficult mountain grades and wastes of sand are not insurmountable obstacles. High power seems to be indispensable, not so much for the speed which it makes possible, but to negotiate the steep grades and heavy sand. Much of the driving across the plains must be done at low speed, because all the power available is necessary to plough through the sand.

In rough country the machine is preceded by a man on foot who gives timely warning of approaching mule teams on the narrow roads. Automobiling in search of likely prospects is not touring for pleasure, but it is far less fatiguing than tramping the desert with animals. The prospector steps out of his car at the end of his journey fresh and fit for work.

So common is the motor car in certain mining districts of Nevada that travelers frequently find it easier to get gasolene than to get water either for drinking purposes or for cooling the motor.

Signs of Improvement

The present activity on the Stock Exchange and the gradual gains in prices of the important metals may be taken as signs of the passing of the depression of the past year; just as the break in stocks and the fall in metals preceded the panic of last October. Stock Exchange advances may savor of manipulation, and of the work of certain interests; but, after all, Wall Street has a certain foresight, the correctness of which has often been proved by events. Of course, the tendency is always to go too far and too fast, and to discount the future at too high a rate, but this does not disprove the accuracy of the general direction. The steady advance in metals is evidence of an increasing demand, which is based on solid improvement and confidence in the future.

THE GARFIELD SMELTING Works appears still to be having more or less trouble, due chiefly to the draft system. A single chimney may satisfactorily serve a large plant of this character, as for example the Washoe works, but it is neither theoretically nor practically the best arrangement. In this respect the Steptoe smelter, with a chimney for each department, presents a more logical design. In zinc-smelting practice there is a chimney for each pair of furnaces.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Safety of Coal Mines

With reference to safety in coal mines, there are four important things to be considered: (1) Examination for miners; (2) apprenticeship for miners; (3) clearance letter, or service letter for all underground men; (4) improvement in the camp living conditions.

A law providing for and governing the examination of miners should be national so as to be uniform in all States and Territories, and to be carried out without partiality and injustice. It should provide for a sufficient number of capable men on each State examining board to do the work thoroughly and conveniently. Three men should be on each board, and examinations held at suitable times in each camp, or some city easily accessible to the men to be examined.

I would recommend a fee of $5 for the examination so as to prevent any "railroading," and deter persons that feel doubtful about being competent from taking the examination until they are fully prepared; also to make the examining board as near self-supporting as possible.

The examinations should be conducted in a manner that will not only determine what the applicant knows, but will do some educational work at the same time. In addition to the practical things a miner should know, there should be some questions of a theoretical nature, so as to induce reading on the part of the men.

The men now working as miners should be required to pass a practical examination; and while these cannot at first be made as severe as they should eventually be, they should be rigorous enough to eliminate the incompetent. The State laws should be made more nearly uniform, and prepared to fully cover the duties of superintendent, pit-boss, fire-boss, engineers, miners, etc., and of the operator. No one objects to laws if all are compelled to comply; heavy penalties should be provided for violations. The requirements for certificates should be: (1) Age, 21; (2) American citizen—the foreign element feel more amenable to our laws when naturalized; (3) Ability to read and write English. This is of the utmost importance in order that the men may be able to read notices and instructions, and understand what is told them.

Apprenticeship for Miners

It is more important that coal miners be competent and careful men than in any other class of work, as in no other occupation are the lives of so many fellow workers dependent upon the acts of each individual. Nearly all States require underground coal-mine foremen and fire-bosses to pass an examination before being allowed to serve in such capacities. This is good so far as it goes, but it does not reach the proper men. Practically all the accidents and explosions are caused by the miners, and these are the men that need educating to make coal mining a safe and attractive work.

Some people think it only requires a strong back and a few months' experience to become a good miner, while in fact it is a life study. Coal miners are among the best paid workmen, and they deserve the dignity bestowed on the other classes. Our production is materially increasing, and there will be work for several generations of miners yet to come.

Where there are two "miners" in a place, all instructions must be necessarily given to both, and unless they have been partners for a long time and one is naturally the leader, neither feels like starting first to comply. Again, being equally responsidle, they are each prone to let the other look out for himself.

Under the "miner and laborer" system, the foreman will issue his instructions to one man, the miner, and he will be held responsible for the compliance. Again, the miner will naturally look out for the laborer and prevent him from committing any foolish acts. It will be to the advantage of the miner to get as much work as possible out of the laborer; this will cause him to teach the green man to work to advantage and learn. If the miner is not considerate and steady, he will not be able to keep a laborer, and if the laborer is not steady and willing, he will be justly forced out of the ranks, as he will not be able to get a miner to take him.

There are many capable and safe miners today who have been forced out of the mine on account of being crippled or too old to perform the necessary physical labor. Under this system, his life of usefulness will be greatly lengthened if he could use his "head" and the laborer would perform the heavier part of the work. There are also many men who are averse to going underground, because they are compelled to work with anybody, regardless of personal habits and inability to do his share of the work. A good man does not want a partner that is repulsive to him and one that shirks, and yet wants half on pay day. There are many clean, strong and level-headed young men who would be glad of a chance to learn to be miners if they could go in with a man whom they felt sure would protect them. This system will enable the competent miner to make better money and serve to make each man rely on his individual efforts. The apprenticeship should consist of not less than two years' service, not necessarily at one mine.

A Clearance Letter

The "clearance-letter" system in vogue on all railroads has proved to be a benefit to all concerned. It is a check to the employee and prevents many rash acts. It also enables the employer to learn the man's past record. This will tend to keep a steadier class of men, and when an applicant for work as a miner, having a certificate, applies to the foreman, the latter knows that the man has passed as competent, and from his service letters he will know the applicant's record. There should be a severe penalty for any person issuing a false or misleading service letter. No foreman need hesitate to hire a man who has been previously discharged for some rash act, providing nothing else is against him. The fact that he knows the man's faults enables him to know what to watch for.

The unreliable or unsafe man has no rights that are entitled to consideration, but the other class has a right to demand protection, and to accomplish this end a broad view (eliminating selfishness and personal fears of any possible injustice as an individual) must be taken. Any system is susceptible of some occasional abuses.

Improvement in Camp Living Conditions

The living conditions in coal camps are anything but pleasant. Some of the newer towns are designed to present an attractive appearance outside, and the houses built to avoid sameness, but what improvement has been made on the inside? Not a single closet in the house, no pantry, single floors, so that the children playing on the floor always have colds. The windows and doors let in all kinds of wind and dust, and seldom is there running water in the house. It is a rare thing to even find a kitchen floor level. Workers of the family are compelled to wash in the kitchen, because there is no suitable washhouse. All these things tend to make the wife's work unnecessarily hard.

In the employment problem you will solve nine-tenths of the question by mak-

ing the home conditions such as will make the wife contented. The large factories and mills have discovered this, and have made a notable improvement not only in the working conditions, but in the home conditions. The home conditions are more important than any other.

Increasing wages is an endless chain. The living conditions must be such as will develop the young into useful men and women. If the houses, etc., are built for the worst class, that is the kind of labor the company will get, and conditions will continue to grow worse.

The company stores should be made an inducement for people to live in the camps. Schools should be the best. I do not approve of having a saloon in the camp; however, as there is no use trying to keep liquor from confirmed drinkers, the saloon should be just a bar, no chairs and no room to loaf, no credit extended and no treating; the company to own the saloon, and all the profits go to the betterment of camp life.

Healthy people must have amusement, for if no healthy amusement is provided they will seek other forms. There should be a suitable hall for shows and dancing, a reading room, pool room and gymnasium, and the company should provide for suitable shows, etc., nothing free, but a small charge to make up the deficiency, if any. A baseball nine does wonders toward producing camp loyalty. Some camps are practically run just for the profit made from the store and saloon.

The above, I firmly believe, will greatly increase the safety of coal mining, increase the standard of individual workmanship, and in every way produce a healthier, happier and better class of citizens. As for mechanical safety appliances, the mines are generally well equipped, and something must now be done to reach the individual worker to make the mines safer.

MEL. BUTLER,
Superindentent Big Six Coal Company.

Palmer, Wash., Aug. 1, 1908.

Ore Sampling by Machine

In the article on sampling, by John A. Church, in the JOURNAL of July 18, it appears to me that the author has not investigated conditions at *modern* sampling works, either custom or private, in the Rocky mountain region of the United States. For many years very efficient sampling machines have been in use in the district referred to.

The matter of the separation of the fine and coarse particles in transit through the mill, during the sampling operation, is taken care of satisfactorily in all modern mills by reducing the lengths of the spouts between cutting devices and by using shaking feed for the crushers and rolls throughout the sampling mill.

Again, the cutting machines most in use are time cutting machines, i.e., they are so proportioned and speeded as to take the whole of the stream of ore, for a given interval of time, every so often.

These various improvements correct any errors that might arise from the separation of the fine and coarse particles in transit through the mill.

I have found that there is sampling done at the present time that is almost as accurate as the best assaying. The accompanying table shows, (1) a comparison of sampling plants, under the columns *A* and *B*; and (2) a comparison of assayer's work in portions of columns *B* and *C*. The sampling machines represented by the columns *A* and *B* were both of the same type and had all the improvements referred to. The ore, in 50-ton lots, was put through one sampler and then through the other. In the comparison of assayer's work on the "golds" there is relatively a great percentage of difference, but this is due to the very small quantities of gold in the ore.

A COMPARISON OF SAMPLING.

Lot Numbers.		Per Cent. Copper.			Oz. Silver.			Oz. Gold.		
A	B & C	A	B	C	A	B	C	A	B	C
2463	547	5.10	4.91	4.80	1.90	1.80	1.90	0.020	0.026	0.015
2464	548	3.42	3.82	3.70	1.50	1.70	1.80	0.018	0.026	0.010
2465	549	3.75	3.69	3.71	1.30	1.30	1.40	0.015	0.015	0.007
2466	550	6.13	6.03	5.86	2.10	2.00	2.20	0.015	0.022	0.015
2490	554	4.42	4.22	4.07	1.40	1.40	1.50	0.012	0.020	0.007
2491	552	4.02	4.57	4.48	1.30	1.40	1.60	0.012	0.015	0.007
6231	5730	4.08	4.03	4.01	1.70	1.60	1.40	0.02	0.02	0.025
	118	3.54	3.38		1.30	1.30		0.007	0.007	
2118	38	7.03	6.95		6.9	7.8		0.015	0.012	
2119	37	7.44	7.01		6.6	6.9		0.015	0.015	
2121	40	9.15	9.32		10.7	10.10		0.022	0.03	
2122	45	15.11	14.48		53.20	53.20		0.010	0.010	
2124	46	6.91	5.98		18.6	17.70		0.010	0.012	
Total of assays		80.10	78.39	30.63	108.50	108.20	11.80	0.191	0.230	0.086
Mean		6.16	6.03	4.38	8.35	8.32	0.169	0.015	0.018	0.012
Difference			0.13			0.03		0.003		
Per cent. difference		2.11			0.36				16.67	

COMPARISON OF ASSAYERS.

Total of assays		31.27	30.63		11.20	11.80	0.144	0.086
Mean		4.47	4.38		1.60	1.69	0.0206	0.0123
Difference			0.09		0.09			0.0083
Per cent. difference		2.01				5.33	40.29	0.0083

E. P. MATHEWSON.

Anaconda, Mont., July 28, 1908.

Over-Balance Weight for Single-Drum Hoist

In the JOURNAL of Aug. 1, I note the comment of J. J. Smith on an article by S. A. Worcester in the JOURNAL of May 2. Mr. Smith deplores the fact that Mr. Worcester suggests a patent, for the latter states in his article, "that the management decided to install the overbalance weight, my invention, on which patent is now pending."

Mr. Smith is right. The idea is old and has been used many times at many different places. The Cresson mine at Cripple Creek was the first mine in that great district to use a counterweight. It has been in use over two years without any hangment of Mr. Worcester to design one for the Findley. So the Cresson antedates the Findley, and further many counterweights antedate the Cresson. The only differences in counterweights in in the design, or possibly in the casting. Mr. Collins, now with the Montana-Tonopah, used a counterweight at the Combination mine, Goldfield, Nevada, when he was superintendent there. So it is obvious that Mr. Smith is right and that the idea is old and unpatentable.

The advantages of the use of a counterweight are well and skilfully stated by Mr. Worcester.

RICHARD ROELOFS,
Supt. Cresson Mine.

Cripple Creek, Colo., Aug. 5, 1908.

Dry walling (G. Preumont, *Min. Journ.*, June 20, 1908) is called *poteo* in Peru and Bolivia and is much used. The dry walls are quite similar to those built in Mexico, as in both countries the system was introduced by the Spaniards. In forming the arch for lining a drift, stones cut to fit are used; these stones are cut in quarries, generally from a dacite or a diorite, and are sold to the mines in large quantities. At Corocoro these cut stones for the arch cost from 2 to 4d. each. The cost of dry walling a drift with the wage of the men at 7s. 6d. per day is from 24 to 35s. per foot.

The National Conservation Commission

The outcome of the recent conference on the conservation of national resources has been the appointment of the National Conservation Commission, of which Gifford Pinchot is chairman and Thomas R. Shipp secretary, both with headquarters at Washington. The first business of the commission is to collect information; and to that end it has now, through its executive committee, presented a schedule of inquiries for the inventory of natural resources. The schedule is the combined result of careful study by the chiefs of bureau concerned and by the executive committee. Criticism and suggestion regarding it are invited. The compilation of material is going forward rapidly, under the supervision of Henry Gannett, who reports substantial progress since the last bulletin was issued.

Under Section A, Public Land Laws, the questions submitted possess interest for prospectors, locators and owners of mineral lands, the title to which is derived from the United States. These questions are as follows:

1. What have been the policies and results of our public-land system?

2. What specific changes are necessary in the public-land laws to promote the best permanent use of the land?

3. Preparation of a code of public land laws.

4. Is the tendency toward larger or smaller individual holdings generally? In any region? (*a*) Farm lands. (*b*) Timber lands. (*c*) Mineral lands.

5. What are the causes for this tendency?

In Section G—Minerals—the questions to which the committee seeks to obtain answers are as follows:

1. Approximate quantity of our mineral resources: (*a*) Mineral fuels (coal, lignite, oil, gas). (*b*) Iron ores. (*c*) Other ores and minerals.

2. Approximate production and use: (*a*) Annual production and consumption, and total production to date, of each important mineral. (*b*) Rate of increase of production. (*c*) Influence of re-use of metals on production.

3. Probable duration of the supply of each important mineral.

4. Nature and extent of waste in the mining extraction, and use of mineral products.

5. Methods of preventing or lessening this waste.

6. How can the duration of mineral resources be extended by: (*a*) Complete utilization of by-products. (*b*) Prevention of waste in mining and extraction. (*c*) Increasing efficiency in use. (*d*) Discovery and development of substitutes for materials and methods now in use.

7. Deterioration and loss of metals and other mineral substances through destructive agencies: (*a*) Extent of such deterioration and loss. (*b*) Nature of such action and methods of preventing it.

Under miscellaneous information the committee asks for answers to questions under the head of Life and Property, the first being of special interest to mine operators, and the second of more general application, as follows:

1. Conservation of life and property in mining: (*a*) Nature and extent of loss of life in mining. (*b*) Nature and extent of property losses in mining. (*c*) Causes and probable prevention of mine accidents, mine fires, etc.

2. Conservation of life and property through prevention of surface fires: (*a*) Nature and extent of the loss of life from fires. (*b*) Nature and extent of the loss of property from fires. (c) Total cost of fire losses, fire insurance, systems of fighting fires, water systems for same, etc. (*d*) Possible prevention of such fires through: (1) The investigation of fire-resisting properties of materials. (2) The investigation of fire-proofing systems. (3) Changes in building materials and systems.

Gold in Borneo

The total known production of gold in Sarawak, North Borneo, from the beginning of 1898 to the end of 1907, was 308,629 oz. fine, or $6,379,361. The production for the 10 years, by years, was as follows, in ounces of fine gold:

1898	1,889	1903	40,329
1899	12,499	1904	41,341
1900	20,851	1905	44,299
1901	32,220	1906	39,186
1902	34,256	1907	41,751

The return for 1907 shows an increase of 2565 oz. over 1906, though it was 2548 oz. below 1905, the year of greatest production. The whole of this gold was produced by the two mines in Upper Sarawak belonging to the Borneo Company, Ltd., which has its offices in London. The Chinese do a very limited amount of gold washing in different places, but the government keeps no record of the output. At the best it is insignificant, and cannot amount to more than 100 oz. a year.

At the two mines mentioned about 18,000 tons of ore are handled each month. There is no free gold, and all the material is cyanided direct. The ore consists of metamorphosed and brecciated shales, but the bulk of the gold is obtained by cyaniding the clays, which are decomposition products of the shales. This is done at one mill by treatment in lumps in very shallow vats—2 ft. deep—and at the other mill by puddling the clays, fine grinding the ore and sands and filter pressing. A large installation of Ridgway's vacuum filters is now being put in.

Borneo is one of the countries which have not been thoroughly prospected, and it is not improbable that other gold deposits may be found in time.

Mount Morgan Gold Mining Company, Ltd.

The 23d annual report of the Mount Morgan Gold Mining Company, Ltd., is for the year ended May 31, 1908. In this year the total receipts from all sources were £911,724, of which £359,838 was from gold won from mundic and oxidized ore, £532,854 from blister copper, £17,617 from copper precipitate, and £1415 from sundry receipts. Against this is an expenditure of £648,360, which includes £65,856 paid to the Queensland government, £326,590 for wages, £255,914 for miscellaneous expenses, and £48,956 written off against plant and machinery account.

The total ores mined and treated amounted to 405,601 tons, which necessitated the removal of 287,834 tons of waste rock. There were 38,037 tons of iron ore, and 89,086 tons of limestone used for fluxes. The metals produced in the fiscal year were 153,092 oz. gold valued at £650,288, and 5561 tons of copper, valued at £278,000. Of the three classes of ore mined the oxidized ore comprised 123,469 tons; sulphide gold ore, 117,770 tons; and auriferous copper ore, 155,714 tons; total, 396,953 tons. The oxidized ore has shown a yearly depreciation in its gold content, and it is believed that mining this ore will have to be abandoned.

The total amount of sinking and driving was 4852 ft., of which 3326 ft. was driving. The overburden removed from the open-cut was 273,000 tons, which enabled the extraction of 154,000 tons of payable ore.

At the reduction works the average grade of all ore treated was 7.06 dwt., of which the ore treated at the Mundic plant averaged 10.89 dwt., and at the West plant, 3.40 dwt. The cost per ton at the Mundic works was 14s. 2.61d., and at the West, 10s. 7.93d., against 13s. 3.21d. and 10s. 6.36d., respectively in the previous year.

The electrolytic copper refinery at Port Kembla, N. S. W., in which the company is interested, is expected to be completed in December, 1908, at which time the company will treat its blister copper instead of shipping it to America for refining.

The contract for the erection of the first cyanamide plant to be built in North America has just been let (*Amer. Fertilizer*, June, 1908). The plant will be built on the Canadian side of Niagara Falls and will have an initial capacity for making 7500 tons of this artificial fertilizer.

At the Corocoro copper mines, Corocoro, Bolivia, inclined winzes with steps cut in their sides are used to connect the levels, which are 22 m. apart. Some of the mines are from 700 to 900 ft. deep and the men enter and leave them through these winze staircases.

South African Mining Notes

SPECIAL CORRESPONDENCE

In view of the recent decision of the Robinson company to erect an extra 50 stamps to treat the large tonnage of Main Reef lying intact below Leader stopes in the greater part of the mine, importance attaches to the reference to Main Reef possibilities contained in the annual report of the Robinson Deep. The superintending engineer states that stoping on certain areas of the Main Reef, which were included in the previous year's ore reserves, has shown that this reef is of erratic value and patchy in character. Although part of this ore will undoubtedly be worked at a profit, it has been thought best to exclude it from the forecast of ore reserves.

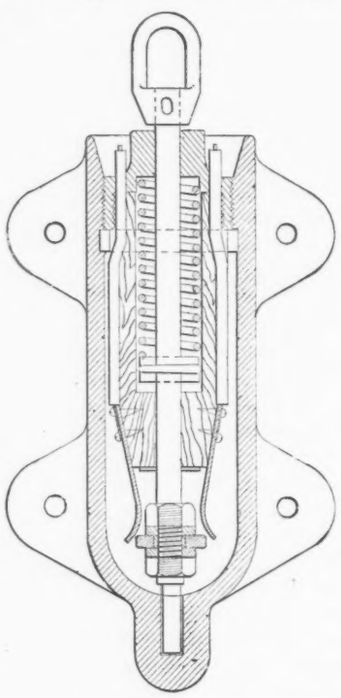
The dissolution of the North Witwatersrand Gold Mines, Ltd., floated in 1904 to exploit the several reefs underlying the Main Reef series to the west of Johannesburg, has come about in what has appeared the natural order of things to many. Financial difficulties are ostensibly the cause of the company's collapse, but a more significant factor has been the failure of development results to justify further big capital expenditures. The auriferous deposits of the Lower Witwatersrand formation, quartz veins, conglomerates and sandstones, have long been known to contain rich patches and were exploited even before the discovery of the Main Reef; but it is now proved almost conclusively that there is little hope of establishing another Rietfontein upon these precarious Northern series.

The Budget speech of the Transvaal treasurer, McHull, was remarkable for the expression of ministerial good feeling toward the administrators of the gold mining industry. Mr. Hull has personally been one of the most unsparing critics of the mining houses, and his remarks are thus doubly gratifying, when he declares that recent results have reflected the "greatest credit upon all who are associated with the management of the mines. I am assured and I believe that a further reduction in working costs is not only possible, but probable, and that we are within measureable distance of the time when the orebody known as Main Reef will become a workable and payable proposition. The government will render every aid which is possible to bring about this desirable result."

The Q & C Electric Pull Switch for Mine Signaling

The slowness of the bell-rope system of signaling when rapid hoisting is being done has caused the development of electric signaling, and the bell rope at the larger mines has become merely a subsidiary system to be used in case of accident to the other systems, and for signaling from the cage itself. At first, simple push buttons were used, but the numerous troubles arising from their use in wet shafts has resulted in several more elaborate, but more satisfactory, electric signaling devices being placed on the market. Some of these devices depend upon the making and breaking of an electric-lighting circuit, others on the ringing of an electric bell.

The Q & C pull switch, made to operate on a bell circuit, is one of these newer water-tight switches which is being used in several of the mining camps of the West. It consists of a make-and-break piece, the copper disk in which is pulled



SECTION OF THE Q & C ELECTRIC PULL SWITCH

against the contacts by the signal cord when the signal is given. A spiral spring breaks the circuit quickly, rendering the signal sharp and distinct. The electric wires enter at the bottom, and the whole is so inclosed in an iron box that it is thoroughly protected from water and dampness. The insulation is either wood, rubber, or vulcanized fiber. This switch can be used with a battery current, or a circuit from the lighting system.

The switch is bolted at the different levels to the side of the shaft post, facing the station and high enough so that the pull rope will be out of the way of timbers which are being loaded from the cage.

This signaling device is used at Butte, Mont., and at Bisbee, Ariz., as well as elsewhere in the West, and appears to give entire satisfaction. It is made by the Quincy, Manchester, Sargeant Company, Old Colony building, Chicago, Illinois.

Sampling in West Australia

In West Australia sampling at the mines is very close and careful, according to E. Davenport Cleland (*Journ.* Chamber Mines, W. A., May, 1908). The drillings from drill holes, section samples from the sides and roof, and grab samples taken from the broken ore while mucking it out are used in determining the value of ore being mined or developed. In drifting, the drillings from the dry holes are assayed in samples representing 2-ft. sections along the vein. As soon as a round of holes is blasted and cleaned out, the fresh face is sampled and then the sides of the drift in sections of 2 or 3 ft., at right angles to the dip of the lode. Finally a grab sample of the broken ore is taken as it is loaded into the cars. In order to prospect for parallel veins, 5-ft. holes are drilled, at intervals of 10 or 15 ft. along the drift, into the wall or walls of the vein. The drillings from these holes are sampled in 3-ft. sections.

Crosscuts in ore are sampled in 3-ft. sections along their length, and both the drillings and the muck are sampled as in the case of drifts in ore. In the case of crosscuts in country rock, two samples, one on each side of the crosscut, are taken for each round of holes blasted. When ore is found the sections are carefully resampled. The drillings from one of the holes in the face are also assayed. Before abandoning a crosscut a hole from 10 to 15 ft. long is drilled in the face, and the drillings assayed in 3-ft. sections.

The faces of raises are sampled in 30-in. sections after every round blasted. In winzes, samples are taken along the ends as close to the bottom as possible, for there is too much danger of salting the sample with fines if the bottom of the winze is sampled. In both raises and winzes, holes are drilled into the sides at stated intervals and the drillings sampled in 2-ft. sections.

In stopes, while work is in progress, the faces are sampled in 3-ft. sections across their entire width. Holes 6 ft. deep are also bored into the sides, at 15-ft. intervals along the stope. In case any ore is disclosed the payable width is stripped off and the face sampled.

The position of all samples, together with the value and width of the ore, is recorded and ore reserves are computed when developed on three sides. The vein is divided into blocks 100 ft. in length along the vein, and the value and tonnage of ore in each block is calculated separately.

A writer on the copper and brass industries states that scrap copper wire of high conductivity makes excellent metal; and if it is pressed together in small bundles the loss in melting is slight. Scrap telephone wire is not so good for brass making because it often contains silicon.

New Publications

ANNALES DE LA SOCIETE GEOLOGIQUE DE BELGIQUE. Vol. XXXV, Part I. Pp. 33, illustrated. 6½x10 in.; paper. Liege, Belgium, 1908: H. Vaillant-Carmanne.

POOR'S MANUAL OF RAILROADS, 1908. Forty-first Annual Number. Pp. 2074. 6x9 in.; cloth, $10. New York, 1908: Poor's Railroad Manual Company.

The fact that the present issue is the forty-first in yearly series is, perhaps, the best comment that is needed. "Poor's Manual" has long had an established reputation as an authentic source of information on railroads and railroad securities, which has made it indispensable for all who require such information. The introduction gives a summary of railroad operations and results which is nowhere else to be found in condensed form. Its figures are generally accepted as authoritative. The present volume bears all the marks of careful compilation and accurate statement which have marked its predecessors.

COLLIERY EXPLOSIONS AND RESCUE APPLIANCES. By W. Galloway. Pp. 120; illustrated, 7x10 in.; paper. London, 1908: Gresham Publishing Company.

The book is a valuable addition to the author's work entitled, "Practical Coal Mining." The question of barometric pressure as an agent in causing gas explosions in mines is dealt with in detail. Methods of detecting firedamp, and a discussion of the various safety lamps are included. The chapter devoted to blasting is thoroughly practical, and contains an excellent description of modern methods of testing explosives. The most popular and interesting discussion is that relating to coal dust. The volume is the author's best contribution to the subject of colliery explosions, and is the most modern work yet produced along this line.

THE LABOR HISTORY OF THE CRIPPLE CREEK DISTRICT; A STUDY IN INDUSTRIAL EVOLUTION. By Benjamin McKie Rastall. Bulletin No. 198, University of Wisconsin. Pp. 166; illustrated. 6x9 in.; paper, 50c. Madison, Wis., 1908.

This is an interesting account of the series of labor troubles which was the most bloody and in all respects the most disgraceful in the recent mining history of the United States. No good citizen can review it in the pages of this book without a feeling of shame that such things were. When in the strike of 1894 the State of Colorado through its force of deputy-sheriffs recognized the belligerency of the strikers, under arms, to the extent of arranging with them an exchange of prisoners there was a sacrifice of dignity that bore terrible fruit in the more serious strike of 1903-04. Mr. Rastall tells the history of both the strikes with an unusual minuteness of detail; much more, we think, than there is any good reason for doing. As a history, which is well-told and is as entertaining as a romance, his work is a great success. As a sociological study of the labor conditions which permitted these strikes and the part of the Western Federation of Miners it is decidedly weak. We must say, however, that Mr. Rastall's work impresses us as being done in a remarkably impartial manner, and we have no doubt that it will find unqualified acceptance as an accurate statement of facts, from which subsequent students of the labor question will be able to deduce their own conclusions.

PEAT AND LIGNITE: THEIR MANUFACTURE AND USES IN EUROPE. By E. Nystrom. Canada Department of Mines. Pp. 247, illustrated. 6¼x9½ in.; paper. Ottawa, Canada, 1908.

This publication embodies the results of an exhaustive investigation, undertaken under the direction of Dr. Eugene Haanel, Canadian director of mines, into the peat industry of Sweden, Norway, Finland, Denmark, Germany, Holland and Ireland to ascertain how far the methods, processes and machinery, in use in Europe for the exploitation of the peat deposits, are suitable to Canadian conditions. Canada possesses extensive and widely distributed areas of peat bogs, the total extent of which is 37,000 square miles, according to a statement of Dr. R. Chalmers, of the Canadian Geological Survey, based largely on estimates so far as the West is concerned.

The exhaustion of the forests and the increasing value of wood for other than fuel purposes has made the problem of fuel supply one of increasing importance, and has directed attention to the undeveloped peat resources and several attempts have been made to manufacture peat fuel; but in most cases financial failure has been the result. As the author points out, the industry in those European countries where it is now firmly established had to pass through a similar phase at the outset. The methods at present used for peat-fuel manufacture depend upon air-drying, the question of economically removing the water from the peat being the main problem. The industry abroad is largely carried on in connection with drainage works with the object of rendering the land, which is practically valueless in its original state, fit for cultivation. In the more thickly populated sections of Canada the increased value of the land when drained would be a substantial factor. A detailed account of the assistance afforded by European governments is given.

The opening chapters of the report deal with the occurrence, classification, composition and calorific values of peat and its various economic uses. Analyses of the Canadian product indicate that it compares favorably with many of the European peats, the percentage of combustible matter ranging from 66.80 per cent. for the Brockville, Ont., peat, to 81.64 per cent. for that of Ste. Thérèse, Russell county, Ont. The most important feature of the work is the detailed description of the processes and plants employed in the manufacture of air-dried peat fuel in the countries visited. There are copious details of cost of plants and of production. The manufacture of peat and lignite briquets is also fully dealt with. A point which is strongly emphasized is that the method and machinery employed must be suited to the nature of the bog to be worked and to local conditions.

In Canada, at least in the southern parts of the central provinces conditions are quite as favorable for the manufacture of peat fuel as in Europe. While the method of adding water to the peat in the pulping and mixing machine can be recommended where suitable drying fields can be obtained, or where only a small production is required, in the majority of cases the employment of peat machines is regarded as preferable. Where bogs are comparatively free from roots, trunks and stumps, the employment of mechanical excavators is a great advantage, the machinery and method invented and used by O. Strenge at Elisabethfehn, Oldenberg, Germany, being probably one of the best. In cases when roots and stumps are present the advantage of mechanical excavators is doubtful and the most suitable machinery and methods are those invented by A. Anrep, of Sweden.

Mr. Nystrom does not speak encouragingly concerning the manufacture of peat briquets, which has not, so far as can be judged, proved a lucrative undertaking in Europe. The increased fuel value does not cover the extra expense of artificial drying and briquetting. The wet-carbonizing process by Doctor Ekenberg of London., Eng., however, is promising and is attracting some attention. Lignite briquetting, on the other hand, has proved satisfactory and attained large proportions in Germany, and the author considers that part of the lignites in Manitoba and Saskatchewan would prove suitable for treatment by these methods.

Among other branches of the industry which might be found remunerative in Canada, the report refers to peat powder, peat coke and peat gas for power purposes. With power plants erected at the bogs the bulkiness of peat fuel would be less of a drawback, and as the peat employed in gas producers can be used with about 40 to 45 per cent. of moisture, the drying conditions would be of less importance. The manufacture of moss litter for bedding and packing purposes is a growing industry in Europe and peat mull is also used with satisfactory results as packing material. The use of peat for the manufacture of textiles, paper and alcohol is regarded as being too experimental to warrant recommending enterprises of this character.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of of their movements and appointments.

G. C. Kaufman, of New York, is in Mexico on professional business.

R. H. Toll, of Denver, Colo., is examining mines in southwestern Colorado.

S. F. Shaw, of Chicago, is engaged in examining some mines near Jimenez, Chihuahua, Mexico.

Mark B. Kerr has opened an office in the Mills building, San Francisco, as general consulting engineer.

W. H. Paul, formerly of Colorado, is now manager of the Dolores Mines Company, Dolores, Chihuahua, Mexico.

Joseph William Teale has been admitted as a partner in the firm of Bainbridge, Seymour & Co., Salisbury House, London.

S. W. Mudd was in Salt Lake, Utah, recently, after having made an examination of the Ray copper mines in Arizona.

Francis J. Peck, of the firm of Francis J. Peck & Co., Cleveland, Ohio, is examining property in Canada for eastern capitalists.

W. E. Defty has left Mexico and is now making mine examinations at Breckenridge, Colo., and in the Leadville district.

R. McCluskey, of Georgetown, Colo., has gone to Alamagordo, N. M., to assume the management of a copper property.

Fred Hoar, superintendent of the Lake Superior & Arizona mine of Arizona, is a visitor at the Lake Superior district for a short time.

C. W. Purington, who is at present in the Ochotsk district of East Siberia, is expected to return to San Francisco in November.

George Crerar has been appointed treasurer and general manager of the Beryl Mining Company, of Baja California, Mexico.

J. P. Miller has been appointed assistant general superintendent of the properties of the Ellsworth Collieries Company, at Ellsworth, Penn.

R. S. Weitzell has been appointed general superintendent of the Sunday Creek Company's Hocking mines, with headquarters at Athens, Ohio.

Silas W. Eccles, vice-president of the American Smelting and Refining Company, was in Salt Lake, Utah, last week, on his return from Alaska.

W. P. Dunham, of Los Angeles, Cal., is in Chihuahua, Mexico, on his way to Pinos Altos, in which section he is carrying on extensive operations.

John A. Traylor, of the John A. Traylor Engineering Company, Denver, Colo., has been spending a few weeks in the State of Chihuahua, Mexico.

H. Forbes Julian, cyanide expert with Chas. Butters & Co., Ltd., has been in Mexico City for several days on his way to Salvador, Central America.

J. E. Spurr has been making an examination of the West End mine, at Tonopah, Nev., for the owners, with a view to planning future development work.

Percy A. Babb is in Jalisco, Mexico, for the Mexico Mines-Prospects Development Company. His company will shortly build a mill and cyanide plant in Oaxaca.

William Mungall has resigned as superintendent of Ellsworth Nos. 3 and 4 mines at Ellsworth, Penn., to accept the position of general manager of the Fife Coal Company, of Scotland.

D. W. Shanks, general manager of the Compañia Minera de Rio de Plata, has returned to Chihuahua, Mexico, and will shortly leave for Los Angeles, Cal., to be absent several weeks.

W. J. Mitchell, superintendent of mines for the American Smelting and Refining Company, at Santa Eulalia, Chihuahua, Mexico, has returned to the mines after six weeks in California.

John H. Kirby, president of the Kirby Development Company, has been in Mexico City with Fred E. Erwin, of New York, who is reporting on the properties of the company in the State of Jalisco.

S. Herbert Coxe has been appointed professor of mining in the Royal School of Mines, London, and has, therefore, severed his connection with the firm of Bainbridge, Seymour & Co., mining engineers.

E. H. Coxe, superintendent of coal mines of the Tennessee Coal, Iron and Railroad Company, was slightly wounded Aug. 9, in an attack made by strikers at Blocton, Ala., on a train carrying non union miners.

Benjamin Magnus, general manager of the Electrolytic Refining and Smelting Company, of Australia, is erecting a large plant at Port Kembla, New South Wales, and has his present address at that place. He expects to have two 100-ton refining furnaces ready by December.

On July 22 a large number of leading members of the British Iron Trade Association assembled in London to do honor to James Stephen Jeans, the occasion being his retirement, owing to ill health, from the position of secretary, to which he was appointed in 1877.

The partnership existing between Charles J. Bandmann and W. J. Adams, as mining engineers, has been dissolved by mutual consent. C. J. Bandmann retains the offices in the Monadnock building, San Francisco, and will settle the accounts of the firm. W. J. Adams has established his office at No. 237 Sansom street, San Francisco.

F. G. Clapp, for seven years with the United States Geological Survey, engaged in investigations and preparation of reports on coal, oil, gas and artesian waters, has resigned from the service, in order to engage in expert practice of geology and allied branches of engineering. A partnership has been formed with A. W. Bee, Jr., and office opened in Pittsburg.

Obituary

Cyrus W. Merrell died in Cleveland, O., July 22, 1908, of pneumonia. Mr. Merrell was associated for 26 years with Oglebay, Norton & Co., of Cleveland, and was secretary of the Commonwealth Iron Company, the Montreal Mining Company, the Bristol Mining Company and the Castile Mining Company.

Charles Gordon Zug, vice-president and general manager of the Zug Iron and Steel Company, of Pittsburg, died at his summer home in Flushing, N. Y., Aug. 10, aged 36 years. He was born in Pittsburg, graduated from the Western University of Pennsylvania, and had been long connected with the company, which was established by his father.

The many friends of Charles F. Shelby, for many years connected with the smelting industry in the United States, at Denver, Aguas Calientes, Mex., and Globe, Ariz., and at present superintendent of the reduction division of the Cananea Consolidated Copper Company, Cananea, Mex., will hear with regret that he arrived in New York, Aug. 7, on a sad mission. He came to take charge of the body of his wife, who died at Far Rockaway on Aug. 3. Mr. Shelby left the same day with the body on a special train for Omaha, where the interment will be made. Mrs. Shelby had been ill since last November, and recently it was found that she was suffering from internal carcinoma and that the disease had progressed too far to be cured. Mrs. Shelby leaves no children. The funeral services were held in St. Patrick's Cathedral, New York.

Societies and Technical Schools

American Chemical Society—As recently noted in our columns, the New Haven meeting of this society was marked by the organization of the Division of Industrial Chemists and Chemical Engineers. Arthur D. Little, of Boston, was elected chairman of the division and vice-president of the society, and indicated in his address the broad field awaiting development by the new organization. The division will include a large proportion of the membership of the society and especially those engineering chemists whose work is directly concerned with industrial development and progress. The division will begin the publication at an early day of the *Journal of Industrial and Engineering Chemistry*, for which a strong board of editors was elected.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Salt Lake City, Denver, Goldfield, Toronto and London

REVIEWS OF IMPORTANT EVENTS

San Francisco

Aug. 5—On Monday of this week the board of supervisors of Solano county ordered that all permits heretofore extended to the Selby Smelting and Lead Company to operate its plant be revoked, and that the plant be entirely shut down in obedience to the injunction. They seemed to think that sufficient time had been allowed to test the fume-arresting appliances and were not convinced that the company was acting in good faith in delaying final proof of the efficiency of the apparatus. Meantime the Home Protective Association, composed mainly of residents of Burlingame, San Mateo county, is again active against the establishment of the new Guggenheim smelter at Point San Bruno. The people of South San Francisco are about to incorporate their town, within the limits of which is the smelter site. The Burlingame citizens think this is a move to take the jurisdiction of the smelter site from the county supervisors, into that of the council of South San Francisco, the latter place being in favor of having the smelter built. The San Mateo supervisors have adopted an ordinance so restrictive that it is virtually prohibitive as to operating smelters.

The superintendent of one of the gold mines in the mountain region who employs 50 miners steadily, states that there have been more applications at the mine this summer for work than has been the case in two years previous. Numerous good miners from other parts of the State and from other States sought employment. Numbers of men who went to the new camps in Nevada have returned.

A hearing has been held at Quincy, Plumas county, wherein the government is contesting the right of N. I. Golden and E. V. Darby to certain mineral claims in the Massak section east of Quincy, for which they recently made application for patent. The government officials filed a protest against the issuance of patent, claiming that the ground is not more valuable for mineral than for other purposes. The testimony is to be forwarded to the Land Department at Washington.

The Tom Head copper mines lie 30 miles west of Red Bluff, Tehama county, and while they have never yet become productive, some extensive development work has been done upon them and the deposits are supposed to be very large. They are owned by the California-Massachusetts Copper Mines Company. Now the recently organized Chicago Copper Refining Company will lease the property.

Goldfield, Nevada

August 5—All leasing records, not excepting the world-famous Hayes-Monnette, which gave Goldfield its first fame, are being broken by the Engineers Lease on the Florence ground. It is only mining 50 to 75 tons of ore per day, but that averages nearly $600 per ton.

The State bullion-tax agent is making a tour of the State in an effort to round up all the producing mines, very few of which make the proper legal returns.

The experiments at the Kinkead mill in this city by the Consolidated have proved so completely successful that a new plant is being designed as an adjunct to the new 600-ton mill now in the course of erection. The new process, which is the subject of letters patent, is briefly a sulphuric-acid treatment of the sulphide concentrates converting into soluble sulphates the deterent sulphur compounds. The concentrates are then de-acidized and washed in filter presses, and the resulting residue is cyanided.

Salt Lake City

August 7—The ore and bullion settlements reported by Salt Lake banks last week aggregated $405,000 and $1,456,500 for the month of July.

During July there was produced from Utah smelting plants between 8,000,000 and 8,500,000 lb. of copper.

Dividends have been declared by the May Day and Uncle Sam Consolidated companies, operating in the Tintic district, for August payment. The former, 1½c. per share, or $12,000; the latter, 4c. per share, or $20,000.

Not later than August 15, the United States Smelting, Refining and Mining Company will have its new converter roaster plant in operation at Bingham Junction, when the treatment of sulphide lead-silver ores will begin. Since the resumption of smelting operations at the United States plant about a month ago, only oxide ore has been received owing to the incomplete condition of the converter roasters. The smelter management asserts that with the devices installed and in use at the present time it will be absolutely impossible to do any damage to growing vegetation. It was only upon a guarantee of this kind that Judge Marshall consented to a modification of the decree of injunction which caused practically every smelting plant to cease the treatment of ores in the Salt Lake valley last December and January. The United States Company, has started up its concentrating mill, which is located near the smelter, on ore from its lead properties in Bingham. The plant has capacity for the treatment of 300 tons per day.

Among the important events of the past week has been the resumption at the properties of the Ohio Copper Company in Bingham, following closely upon the announcement that the bonds authorized by the board of directors had been underwritten by an eastern syndicate. Until recently F. Augustus Heinze has been a controlling factor in this enterprise, but he is said to have relinquished a large stock interest to others who have come to his assistance. It will probably take until about Jan. 1 to place the property in condition to produce upon a large scale. The concentrating mill building, completed early in the year, will be immediately equipped to treat 2000 tons of ore per day and plans have been made to double this capacity. The Mascotte adit, possession of which was obtained from the Bingham Consolidated Company, will be pushed ahead about 300 ft. further to a point where a raise will be made to connect with the bottom of the main working shaft. The face of the adit is in a good grade of milling ore. An electrically equipped railway, which is to become the property of the Bingham Central Railroad Company, organized recently, will be operated through the Mascotte adit and it is figured that the cost of transporting the ore to the mill at Lark will not exceed 15c. per ton. The amount of Ohio bonds authorized was $2,000,000.

Butte

August 7—The camp seems to be gradually recovering from the severe setback which it received during the past winter when the price of copper declined and a general shut-down followed. Each week brings with it a resumption of operations in some one of the smaller properties in the district. At the Leonard mine of the Boston & Montana company two Nordberg quintuplex pumps have been installed on the 1200-ft. level. Each pump has a capacity of 600 gal. per min. At the Tuolumne mine the company has begun the construction of ore bins. A station is being cut at the 800-ft. level and a crosscut will be run to the lead which was recently cut on the 1000. At the Tramway mine of the Red Metal company, construction work on the surface is under way and new ore bins have been started. Operations have also been resumed at the properties of the Butte-Milwaukee company.

Denver

Aug. 7—As reported by the mills and smelters, the Cripple Creek district produced gold to the value of $1,345,031 in July.

Lessees on the Fluorine mine of Cripple Creek are preparing a shipment, the first for some time past from this old-time producer, which is located on what is regarded as the northern limit of the producing area of this district.

Phenomenally rich ore is reported to have been struck in the Trilby mine between the sixth and seventh levels. The ore occurs as an 18-in. streak of sylvanite in a 30-ft. vein.

Geo. A. Pettibone, of Western Federation of Miners notoriety, died from cancer Aug. 3, in Denver.

From Leadville comes the report that on Sept. 1, the Little Jonny, now called the Ibex, will resume operations after a month's shut-down for repairs and installations of new machinery on No. 4 shaft. The property is being worked under the leasing system.

Work has begun on the Koehler Tunnel in the property of the same name, a part of the San Antonio group of mines, near Ouray. This tunnel is designed to develop at depth the copper orebodies encountered at higher levels.

In the Telluride district all the larger mills, including the Smuggler, Tomboy, Liberty Bell and Alta, are running at full capacity, and it is reported that more men are now employed in the district than for many years past.

The mines of the Durango district are being actively worked, particularly in the vicinity of the May Day and Idaho. Most of the properties now operating are being worked by lessees.

A great deal of excitement has been caused during the past two or three days in Glenwood Springs and vicinity by the report of a rich gold strike on Elk creek, about six miles from New Castle, an important coal-mining town of the Western slope.

Birmingham, Ala.

Aug. 10—The first serious case of violence in the present strike of coal miners occurred near Blocton, on the Birmingham Mineral road, very early on the morning of Aug. 9, when a party of strikers fired on a train, killing three men and wounding 11 others. The killed included the conductor of the train, a deputy sheriff and a non-union miner. Among the wounded were three officers of the company, several deputy sheriffs and six miners. The train was a special, carrying non-union men to the Blocton mines under guard of soldiers and deputies. On the outskirts of the town the engineer suddenly saw a log across the track, and at once a fusilade was fired into the train. The engineer did not stop, but let the cowcatcher throw the log from the track and put on full speed. Where the attack was made was in a cut, the ground being on a level with the lowest part of the windows. The assailants on the rocks above poured down a fire directly into the windows and at the engineer. Practically every window in the train was broken, and shots struck all parts of the engine and cab. The train proceeded to Blocton, and the dead and injured were returned to Birmingham.

Troops were at once sent to the spot, and later some 30 men were arrested, charged with taking part in the attack. While many of these men were negroes, it is believed that they were led by some of the foreigners who were brought to Alabama three years ago, at the time of the former strike, and who are now themselves among the strikers.

This murderous outbreak will be the cause of an increase in the use of forcible measures to prevent trouble, and will result in an advantage to the companies, which are trying to break up the union in Alabama.

Toronto

August 8—A decision has been rendered by Judge Russell, of Halifax, N. S., confirming the title of the Dominion Coal Company to extensive submarine coal areas off Point Aconi, Cape Breton. Some months ago the Dominion Iron and Steel Company secured from Mr. Burchell, of Halifax, options on coal areas in the same locality, but lying farther out. The Coal company's areas lie between these lands and the shore and interfere with the direct working of the Burchell areas. An action was brought to set aside the leases of the Dominion Coal Company, Burchell and the Steel company contending that the areas were improperly designated. The result of the litigation seems to render the property unavailable for operation by the Steel company unless by arrangement with the Coal company.

The negotiations for the purchase of the New Campbellton coal mines at Cape Breton which have been under way for some time were closed this week by B. F. Pearson for Messrs. Harmsworth, English publishers. The lands include four or five square miles of coal which will be used in the purchasers' pulp and paper mills at Grand Rapids, Newfoundland.

London

Aug. 1—A reconstruction scheme for Strattons' Independence, Ltd., is announced. The old company sells its property and assets to a new company with a nominal capital of £125,000 in 1,000,000 shares of 2s. 6d. each, which will be issued to the shareholders of the old company at the rate of one new for one old share. The new shares are credited with 1s. 6d. paid, leaving a liability of 1s. per share. The new scheme will, therefore, bring in £50,000, if all the shares are taken up. A scheme to provide further funds by the issue of debentures was insufficiently subscribed. In June, 1907, money was raised to erect a mill according to the designs of Philip Argall. This mill has now been erected, but the cost has exceeded the estimates by some £10,000, and it is owing to this that a reconstruction of the company has become necessary. The new mill will treat the ore on the dumps and the reserves of low-grade ore available in the mine. It is reported that during the current year the mine has about paid its way. During the month of June of this year the profit was $2140. The chairman announces that profits of £30,000 per year may reasonably be expected, and probably much more, especially if the improved outlook in the mine continues.

The directors of the Ashanti Goldfields Corporation announce that their scheme for obtaining further funds in order to increase the milling plant has fallen through, as they could not get the consent of the debenture holders to the proposals. Additional plant is, however, to be provided, although on a smaller scale than at first contemplated. A filter-press plant for treating slimes is to be put up in connection with the present stamp mill.

The Tanganyika Concessions have now completed arrangements for connecting their principal mines with the coast by railway. A line is to be constructed from Lobito bay to the Ruwe mine, a distance of 1020 miles. The Benguella Railway Company is to build the line eastward from Lobito bay for a distance of 620 miles, and the Lower Congo Railway Company is to work westward from the Ruwe mine to make the connection over the remaining 400 miles. Another railway from the south is projected from Mabaya on the Rhodesian frontier to the Star of the Congo mine, to be built by the Katanga Railway Company. This line is eventually to pass through the copper belt to the Ruwe mine. The section from Broken Hill to the Congo frontier at Mabaya is to be constructed by the Rhodesian Railways Company.

These agreements, if carried out, will mean the opening of a large part of the African continent which is at present little known to white men. The country through which the new railways run will be first explored, but there will not be wanting explorers and hunters, who will take advantage of this fresh move into Central Africa. With an advanced base, they will pass still further into the heart of the dark continent. A short time ago it was somewhat of a feat for a traveler to visit the great lakes or the Victoria Falls. Now such journeys are made every day, owing to railway and steamboat facilities, by the ordinary tourists. The railways are to open a country for which great things have been claimed as regards mineral wealth; and it will be interesting to see whether there has been exaggeration or not.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

TALLADEGA COUNTY

Alabama Marble Company—This company has been organized to open a quarry on a large scale, near Sylacauga. The marble is said to be of fine quality. John S. Sewell, of Sylacauga, is president of the company.

California

BUTTE COUNTY

Old Glory—This gravel mine near Oroville, formerly owned by the Sunset Mining Company, is being pumped out and reopened by representatives of the Eastern stockholders.

CALAVERAS COUNTY

California—Work has been commenced on this mine near North Branch, F. H. Horswill, superintendent, and a new air-compressing plant for drills is being put in. The tunnel will tap the blue lead running from San Andreas and Mokelumne Hill through Central Hill.

Gwin Mine Development Company—Owing to failure of water supply at this extensive property, D. McClure, superintendent, the working force of miners has been materially reduced. Good milling ore has been found in the 2400 level.

Stockton Ridge Consolidated Mining Company—The Hexter tunnel, driven by this company, is now in 1900 ft. and has less than 300 ft. to go to reach the gravel channel.

EL DORADO COUNTY

Garden Valley Gold Mining Company—This company, H. H. Hicks, superintendent, which recently purchased the Hume property, is opening the Old Lady mine.

FRESNO COUNTY

Arkansas—This mine at Trimmer has completed its first mill run with satisfactory results.

INYO COUNTY

Kruger Group—The principal property at the camp of Kruger, owned by Thompson, Griggs & Moody, is now under bond to Southern California capitalists. There are 15 claims in the group and some ore found is of a high grade.

Skidoo—The new cyanide plant at the mill of this company, Skidoo, has been completed and put in operation. The 10 stamps are kept busy on good ore.

KERN COUNTY

Golden—For this property in Amalie district, J. B. Ferris of Caliente has purchased a 20-ton Lane mill, and water will be piped in from Caliente creek.

LOS ANGELES COUNTY

Gold Spike Development Company—This company at Acton, E. Brough, superintendent, is about to run a tunnel 1000 ft. long to develop the old Red Rover mine. There is a mill on the property which has been idle for some time.

MARIPOSA COUNTY

North Fork—There is a renewal of mining activity in this district 14 miles east of Coulterville. Harris & Sellier, of Groveland, Tuolumne county, owning several mines at North Fork, have bonded the Moonlight mines from Wagner & Stolder, and are building 1½ miles of ditch. A 10-stamp mill is to be erected.

NEVADA COUNTY

Delhi—This mine at Columbia Hill has been compelled to suspend operations owing to shortage of water.

Oustomah—Hayes Brothers, of San Jose, Cal., have thrown up the bond on this mine at Nevada City which they have had for a year; John T. Morgan, the owner, will now work it.

Washington—This company, owning the Giant King and other claims in Washington district, is about to erect a 20-stamp mill and put in a power plant. Three large compressors for machine drills are to be purchased.

PLACER COUNTY

Breece & Wheeler—The old ditch, 31 miles long, on this drift mine is being cleaned out and repaired. It has not been used since hydraulic mining was prohibited years ago. The water will be used for hydraulicking at the Paragon, a permit having been granted.

SAN DIEGO COUNTY

Julian—At this old camp the Owens mine is again being worked as is the Hubbard, and for the latter new machinery is on the way. Bailey Brothers are working several of their claims at Banner in the San Felipe cañon. A reduction plant is being built.

SAN BERNARDINO COUNTY

Alvord—K. E. Ash has leased this mine, 23 miles from Daggett, and has set men at work developing.

Orange Blossom Extension—The new mill of this company at Amboy has been started up, and plans for an enlargement have already been made.

SHASTA COUNTY

Nevada—J. F. Cowdery has applied to the California Débris Commission for a permit to mine by hydraulic process at this mine near St. Louis.

Uncle Sam—Maxwell, Bauer & Myers, leasing this mine at Kennett, have taken 15 tons of high-grade ore from a rich shoot and have shipped it to the Tacoma smelter.

SIERRA COUNTY

South Fork—The force at this drift mine, Forest City, F. W. Kuhfeld, superintendent, has been doubled. The old tunnel 2400 ft. long has been extended half a mile, but has not yet reached the old Bald Mountain channel.

Tightner—A crosscut tunnel for drainage and exploration is being run into the ridge and is calculated to cut the Tightner ledge at 700 ft. depth.

SISKIYOU COUNTY

Gardner & Weed—Lack of sufficient water has caused this hydraulic mine at Greenview to close down for the season.

Siskiyou Gold Mining Company—This property at Hawkinsville is to be equipped with new machinery.

Murray & Coggins—At this mine, Callahan, H. H. Cloud & Co., are installing a cyanide plant.

Morrison—The owner of this mine at Quartz Valley, J. M. Morrison, has brought a new five-stamp mill.

TRINITY COUNTY

Robs Farm—This company has leased the Mountain Boomer mine at Denny to Robert Skinner for two years with an option for purchase.

TUOLUMNE COUNTY

Calmus Mining Company—This company, near Tuttletown, is operating the Arbona mine, which has been placed in charge of A. Trittenback.

O'Hara—This mine at Sonora has been closed for a time. The last weekly clean-up was $26,780. The mine has been yielding phenomenally rich ore.

YUBA COUNTY

California Mother Lode Mining Company—This company, J. J. Cusick, manager, has installed an expensive plant on the Eagle mine at Indiana Hill, near Brownsville, and is about to build a sawmill and install an electric-lighting plant.

compressor and drills, etc. It is the intention to enlarge the mill to 100 stamps.

Colorado

LAKE COUNTY—LEADVILLE

Belvidere Group—Some time ago the shaft on the Belvidere, Horseshoe district, was sunk to a depth of 85 ft. where a good body of ore was encountered. Lou. R. Johnston and associates decided that the most economical way to open the property was by tunnel, and recently a contract was let to drive a tunnel from the foot of the hill 500 ft.; 100 ft. have already been driven, and at the breast two distinct veins were caught running at right angles to the tunnel. One vein is 5 ft. wide and the other 2 ft., the veins being separated by only a thin streak of talc.

Dinero Tunnel—According to surveys only 100 ft. remain to be driven before the Dinero veins are cut. As the veins dip to the west, it is more than likely that the tunnel will have to go another 30 ft. The breast is now heavily mineralized and a heavy flow of water is pouring out of the loose ground.

Helena—At this mine, Iowa gulch, the shaft is now down 625 ft., with 165 ft. still to be sunk. The bottom of the shaft is in mineralized matter. The new pump installed at the 500-ft. level handles the water with ease. When the station was being cut at this point a vein of lead ore was opened and several carloads have been shipped.

Lackawanna Gulch—During the week several experts have visited this section, to the south of the Leadville district. A tunnel has been driven a short distance on the Miller vein and samples give good returns in gold. Lou. R. Johnston and associates have an option on the Miller group, and also control the Theodolite and Robinson groups.

Little Jonny—No. 4 shaft on this property, Breece hill, was closed down Aug. 1 to permit necessary repairs which will take a month. The shaft will be retimbered, and new guides put in for the cage.

Sunday Tunnel—The old Garibaldi tunnel, at the head of California gulch, has been cleaned out, retimbered, repaired and straightened for a distance of 1300 ft., and a large station cut out at 1100 ft. to accommodate the electrical machinery to be used in driving the tunnel to its destination, the Sunday vein on Ball mountain. The machinery, including air compressors, machine drills and motors, is now being installed. At 1200 ft. connections have been made with the old Whiteside shaft, which will give the desired ventilation. Manager M. A. Nicholson expects to reach the Sunday vein by the first of next year. The deepest shaft on the Sunday is 450 ft., and the tunnel will cut it about 450 ft. deeper.

Tiger—On this mine at the head of Iowa gulch, the lessees have been driving a tunnel on the original vein and taking out some fair-grade ore. Recently a crossvein was caught that is 2 ft. wide and carries silver, gold and lead.

SAN JUAN COUNTY

Congress—This mine, near the Ouray county line, has been unwatered, all levels cleaned out and retimbered and drifts are being driven ahead on the four levels of the mine in search of new orebodies. J. B. Ross is the general manager of this company, and N. E. Rumery is superintendent of the mine. Recently, at a depth of 300 ft., an orebody was struck, which appears to be a chimney of considerable size, this ore carrying copper and gold.

San Antonio—This mine, in the Red Mountain district, is now shipping 10 cars of high-grade ore weekly.

TELLER COUNTY—CRIPPLE CREEK

On Aug. 1 the new drainage tunnel was in 2873 ft. Only 203 ft. advance was made in July, owing to the hardness of the rock.

Cresson—The July shipments were about 2000 tons, nearly all from the big ore-shoot on the 700-ft. level. Development is in progress on several levels.

Henry Adney—A new vein, 30 in. wide, is reported opened on the 500-ft. level.

Stratton's Independence—A test run is being made at the new mill. It is on ore from the 100-ft. level, which is expected to run about $15 to the ton.

Taylor & Brunton Sampler—It is reported that this sampling mill has been bought by George E. Copeland and associates. The purchase price could not be ascertained. The sampler, which is situated about half a mile northeast of Goldfield, was built by F. M. Taylor and D. W. Brunton, now of Denver, in 1901, and was put into active operation in April of the following year. It has been operated successfully ever since. Since 1903 Mr. Copeland has been manager of the plant, and as a part owner he will continue in that capacity. The new owners take possession immediately. They have organized as the Copeland Sampling Company.

Vindicator—This mine shipped about 2000 tons of high-grade ore in July. Work is going on in all the levels from 400 to 1200 ft., and the shaft is being sunk 100 ft. below the 1200-ft. level.

Florida

HILLSBORO COUNTY

Coronet Phosphate Company—This company has let a contract to C. G. Memminger, of Lakeland, for the machinery necessary to develop its phosphate lands near Plant City.

Indiana

WARRICK COUNTY

The Cole Drilling Company has discovered four veins of coal on the farm of J. M. Miller in this county. The drill has penetrated 464 ft., and has passed through three veins of coal of excellent quality. The first vein, at a depth of 30 ft., is nearly 3 ft. thick; another at 140 ft. is almost 6 ft. thick, and a third at 332 ft. is 6 ft. thick. All three veins have an excellent roof of hard limestone and slate on top of the coal. The drillers think a fourth vein will be struck at a depth of 600 ft. Already plans are being made to develop the territory.

Hercules Coal Mining Company—This company, at Evansville, has incorporated with a capital stock of $100,000. The company proposes to operate coal mines. The directors are C. C. Thomas, M. A. Thomas and P. T. Ashley.

Michigan

COPPER

North Lake—The North Lake Mining Company has been organized to operate the lands adjoining the Lake property on the north and east. The tract contains 1120 acres and is traversed by the Lake and other lodes for a distance of nearly 7000 ft. The company is capitalized at 100,000 shares, par value $25. As soon as all the details of the organization are completed the company will begin diamond-drill explorations; a complete cross section of the tract will be obtained and the formations will be opened on an extensive scale.

Lake—The shaft on this property continues in the same rich formation that has characterized it from surface. The south drift from the first level continues and is breasted in good ground; it is planned to drive a crosscut from this drift and thus determine the width of the lode. The company is trenching extensively and the ledge is being exposed for a considerable distance. Diamond-drill operations are to be resumed and all the virgin ground of the tract will receive careful attention.

Elm River—The new exploratory shaft has reached the ledge after passing through about 40 ft. of overburden. This shaft is going down vertically on the site of a drill hole which was put down several years ago, the core of which contained a good showing of copper, but at that time no importance was attached to it; it will now be thoroughly investigated. It is planned to put this shaft down between 400 and 500 ft. and then crosscut to the east; in this manner the several lodes crossing this tract will be exposed and their value ascertained.

Mass—This company has rigged a diamond drill at the fifth level of "A" shaft and will explore the territory supposed to be crossed by the lodes recently discovered by the Adventure. The Mass is also carrying on surface drilling in proximity to the Calico lode.

Calumet & Hecla—This company is building an addition to its foundry; the company has been doing practically all

of its own casting for some time and the present plant is inadequate to meet its requirements. A new drill-sharpening plant has gone into commission and is working satisfactorily.

IRON

Penn Iron Mining Company—The Briar Hill shaft of this Menominee range company is being lined with concrete. The shaft is 800 ft. deep and 170 ft. has been lined. The opening was originally 6x8 ft., but this is being changed to a cylindrical shaft about 15 ft. in diameter. The enlargement is made in 60-ft. sections and these are lined when completed.

Missouri

ZINC-LEAD DISTRICT

Delta—This company has just completed a 100-ton mill on its lease on the McGowan land at Spring City. One shaft is in ore at 150 ft., and is producing 40 tons of lead ore a week.

Florence—This company has a new producer in its 40-acre lease northeast of Joplin. Four shafts are in ore and the company has a 70-ton mill working to full capacity.

Grade Brothers—This company has completed its 100-ton mill on the Massey land, near Granby, and has begun producing.

Granby—This company is drilling on its land northwest of the Royal Blue lease.

I Know—C. M. Sheldon is drilling on this lease, which is just south of the strike made by D. M. Sayer on the Granby lease.

Lucky May—This company has been incorporated with a capital stock of $50,000. The stockholders are C. Frank Taylor, Mercer Arnold, Blanche Forsythe and Ray Bond, of Joplin; Winifred Blake, of Carthage.

Ravenswood—This company has been incorporated with a capital stock of $100,000 to operate in the Reeds-Sarcoxie district. The stockholders are Edward E. Gore, of Chicago; C. A. Blair, H. W. Blair and F. B. Clark, of Carthage.

United Zinc—Rich, shallow lead ore has been struck on this company's land east of Aurora. Seven shafts are going down as a result of the strike.

West Mining Company—This company, of Joplin, has incorporated with a capital stock of $60,000. The stockholders are H. E. West, of Independence, Kan.; Jamot Brown, of Carthage, and H. E. Hayler, C. U. Porter and R. H. Barratt, of Joplin.

Wyatt & Co.—This company has struck lead at 40 ft. in an old shaft on the Martin & Haines 40-acre tract. This is another tract added to the mining land of that district.

Montana

BUTTE DISTRICT

Butte & London—At the local offices of the company it is stated that negotiations are now under way for re-financing the company, preparatory to the resumption of operations, and that work may be begun within the next 30 days. At the time work was stopped a number of months ago the shaft had attained a depth of 1100 ft. At this depth crosscuts were run which encountered several veins carrying copper; the ore, however, was not of commercial value.

Davis-Daly—It is stated that the financial difficulties of the company may culminate in a complete reorganization of the corporation, which will carry with it an assessment of $2 per share on the capital stock and thus furnish the means for continuing development work. At the Colorado shaft sinking is in progress.

Ticon—The property, owned by James A. Murray, is situated northwest of the North Butte company's Speculator claim. Work has been resumed under the direction of Alfred Frank, the manager of the Davis-Daly Estates Copper Company, and it is stated that operations will be extensive. The Ticon has been closed down for several years.

Lexington—A rich strike of copper ore is reported on the 800-ft. level. This mine is the principal holding of the La France Copper Company.

DEER LODGE COUNTY

Cable Consolidated Mining Company—Operations were recently resumed at the Cable mine, 20 miles west of Anaconda. For the present the work will be confined almost entirely to prospecting on the tunnel level. For many years the mine has been a famous gold producer. It has been worked intermittently for the past 20 years.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Production—The figures for the three months ending July 30, show that Goldfield is producing at the rate of nearly $10,000,000 yearly. At present both the Consolidated and the Florence are doing no company work pending the completion of their mills. These two mills have a combined capacity of 750 tons and will probably output together about $10,000,000 per year. The actual figures for 13 weeks are 27,559 tons with a value of $2,294,176. The past week's production was 1772 tons valued at $221,950. The Kinkead mill treated experimentally 20 tons of $300 concentrates. The Combination mill treated 595 tons of Consolidated ores. The Western Ore Purchasing Company handled from the Engineers lease 272 tons; Van Riper 100 tons. The Nevada Goldfield Reduction Company treated from the Combination Fraction 457 tons; Mohawk dump, 52 tons; Engineers Lease, 123 tons; Consolidated Red Top, 12 tons; Mohawk Jumbo, 6 tons; Black Butte, 60 tons; Mohawk Combination, 35 tons; Oddie dump, 40 tons.

Great Bend—The new shaft is being sunk 5 ft. per day by three shifts and has attained a depth of 175 feet.

C. O. D.-Waverly—The Waverly lease on the C. O. D. has passed into new hands and work will be resumed. The shaft is down 300 ft. and the property is equipped with a fine plant of machinery.

Kewanas—The sale of the property is officially denied.

Baby Florence—The new compressor is bucking so that the development work is going slowly. Crosscutting on the 200-ft. level to catch the ledge and sinking a winze from the 150 on the oreshoot are in progress.

Third Chance—The company has disposed of a block of stock for the purpose of raising funds to resume operations. The double-compartment shaft is down 340 ft. and there is 300 ft. of lateral work. This lease is in a good location with the Atlanta on the south, C. O. D. and Gold Bar on the north and side lining the Combination.

Goldfield American—This company, which has a shaft 200 ft. deep on the eastern edge of the inside district, will resume operations.

Empire—Another lease has been let and the work of sinking a shaft has been started. The Williams lease will also resume operations as soon as a hoist is installed.

Engineers Lease—This lease on the Florence is keeping up its record. The first shipment was made on June 17 and about two cars of high-grade ore are being shipped every day. The oreshoot has been proved for a distance of 60 ft. in the upraise from the 300-ft. level. The high-grade portion of the vein is about 3 ft wide and it only is being broken. The second dividend of $90,000 was paid this week, making $180,000 paid as a result of six weeks' work, and there is enough money in the treasury to pay another one.

Red Top Consolidated—The low-grade ore in this lease has changed to high-grade, and shipments will begin at once. The rich shoot was encountered about 40 ft. south of the Booth end line and is striking toward this property. The Booth company is confident of picking up the same shoot.

Zinn Florence—With confidence that any lease on the Florence ground will produce high-grade ore, this company is pushing lateral work on the 126-ft. level and sinking for the 400-ft. level in the shaft.

ESMERALDA COUNTY—HORNSILVER

Nevada Empress—An important strike of the district is the new find in this

mine. The oreshoot has been stoped for a distance of 40 ft. to the east on the 50-ft. level of the winze below the No. 3 tunnel, and its end has not yet been reached. Work on the main working tunnel will be rushed and a compressor and air drills will be installed for this purpose.

Great Western—The west drift on the 100-ft. level is being pushed to connect with the leasers' shaft. On the 200-ft. level the east drift is now in 160 ft. with ore all the way; at 100 ft. from the shaft the orebody was 16 ft. wide. The west drift on the 200-ft. level is in 150 ft., almost the entire distance in ore of a good milling grade. This makes the shoot on the 200-ft. level continuous for 300 ft. Returns from the first carload of ore shipped to Salt Lake give $161.30 per ton.

Esmeralda County—Rawhide

Another mill is under way for the Rawhide district. It is located on the banks of the Walker river near Schurz, and will have an initial capacity of 60 tons per day. The foundations for the stamps, engines, etc., are practically completed, and the machinery is en route. In addition to the reduction plant the owners will erect a sampler. The railway grade is now completed to within a few miles of the town and it is expected to be finished in two weeks. Local officials of the road state that trains will be running into Rawhide by October 1.

Rawhide Victor—This company is installing a hoisting equipment on its Hooligan Hill property, and will continue sinking the shaft from its present 125-ft. level.

Grutt Hill Mint—This lease on the Coalition property will install a 25-h.p. hoist and the shaft will be put down another 100 feet.

Anderson & Gundecker Placer—This enterprise is progressing favorably. The shaft is down 70 ft.. and the last sample gave returns of $19 per yard. Water for sluicing will be secured from the Rawhide Water and Reduction Company, which will be furnishing water for both milling and domestic purposes during the present month.

Nevada Humboldt Electric Power and Light Company—This company has been incorporated to supply power to all the camps of the district. Power will be derived from Clear creek, which will furnish 1500 h.p. at the lowest stage of the stream.

Kindergarten Mill—In consequence of its success in reducing low-grade ores, the high-grade ore running from $30 to $200 per ton is now run through the 10-stamp mill in Seven Troughs cañon. The plant is making an even better saving on the high-grade ores than on the low; the tailings average $4 and less.

Lincoln County

Groom—Goldfield men have bought the old mine and have shipped hoisting and pumping machinery to begin active operations. High-grade lead-silver ore was shipped to Caliente 30 years ago, but water in the shaft stopped operations.

Nye County—Bellehelen

Cornforth—On this property an air compressor and a 50-h.p. gasolene engine have been installed, and the tunnel is being driven rapidly to get under the apex of the hill, where it is expected to tap the orebody.

Neversweat—This mine is working a big force of men and is sinking a winze 150 ft. deep on the vein.

Horseshoe Mill—This mill, which has recently been remodeled for the purpose of handling the ores on the dump, has been started up. It is the intention to increase the capacity by the addition of 20 stamps.

Nye County—Bullfrog

Diamond Queen—The original lease is again in ore which runs up in the shipping class. Sinking on the new find is progressing and from this work more than 100 sacks of ore per shift are secured.

Groshong—This lease at Telluride, east of Beatty, is preparing a shipment to Salt Lake. A test shipment to the smelter has already been made and the sorting of the ores on the dump will be gaged by the smelter returns. When the new Beatty mill is completed the Groshong ore will be concentrated there.

Capricorn—Returns on the first shipment show nearly $200 per ton. Two shoots of high-grade have been opened and a new shaft is being sunk.

Sixty-Six Lease—This lease on the National Bank ground has made arrangements to make a shipment to the Shoshone mill. The gold contents will be settled for at $20 per oz. and the same extraction that is being made on Shoshone ores is guaranteed.

Homestake—The mill is crushing about 100 tons per day with its 25 stamps.

Pioneer—The mill for the plant has arrived, and the plant will be in commission in about two weeks.

Rhyolite—The miners of the entire district have voted to accept the Tonopah wage scale to become effective August 8.

Nye County—Johnnie

Johnnie Consolidated—The first step toward the reorganization of the company has been taken by the election of A. D. Myers, of Goldfield, as president. He will shut down the property pending the reorganization. The last brick from the mill was worth about $3100.

Nye County—Manhattan

Manhattan Consolidated—A settlement has been reached by which the various litigants against the application of patents sought by the company have withdrawn their suits and the company is beginning the prospecting and developing of its property.

Nye County—Tonopah

Production—Production for the week amounted to 6065 tons valued at $156,175 as follows: Tonopah Extension, 130 tons; Tonopah Mining, 3500 tons; Belmont, 850 tons; Montana Tonopah, 1100 tons; Midway, 100 tons; North Star, 80 tons.

Nye County—Round Mountain

Great Western—Hydraulicking on the slope of Round mountain is developing very satisfactory results from rather odd conditions. The soil now washed is not more than 1 to 1½ ft. deep to bedrock, but what there is of it is very rich. After the hydraulicking, men are set to work on the bedrock with brooms and a clean sweep is made. The result of the last clean-up for three days on this shallow ground was 250 oz. The bedrock, which is left exposed, is literally fretted with a network of small seams and gashes filled with white talc.

Storey County—Comstock

The Comstock, during the last week in July, produced $30,000, which is the record for 20 years. The output was as follows: Ophir, $16,274; Consolidated Virginia, $5229; Yellow Jacket, $8050; Silver Hill, $708. The Consolidated Virginia has not added anything to the world's supply of precious metals previously for 20 years. Mr. Sturgis and his following will reopen several abandoned workings and it is predicted that Virginia City and the Comstock are entering on a new era.

Comstock Tunnel—At various points in the tunnel and its branches, timbers and tracks are being repaired. The electric locomotive has been sent down to Ward shaft and assembled and made ready for work.

Ward Shaft Association—The new surface steam hoist at the Ward shaft has been started. It has a rated capacity of 2500 h.p. and is the largest on the Comstock.

Sutro Tunnel—A man and four mules died of heat in the Sutro tunnel 8000 ft. in from the mouth during the past week.

White Pine County—Ely

Copper Bond Copper Company—This company have begun sinking on Copper Bond No. 9 and will not do any lateral work until the 200-ft. level is reached, where the mineralized zone as located by the churn drills begins.

Giroux Consolidated—Sinking the Alpha shaft from the 1100-ft. to the 1200 ft. level is progressing. The new smelter is nearly ready to blow in.

Stuart—The Cocomongo stamp mill that is being erected at Cherry creek by the Stuart Gold Mines Holding Company will be ready to run soon. The work has

been much delayed by the lack of competent workmen.

North Carolina

ORANGE COUNTY

A discovery of gold is reported near Oaks, by Whitman & Little, who have been prospecting on a tract of 400 acres, on which they have an option.

MONTGOMERY COUNTY

Iola Gold Mining Company—The United States Circuit Court at Asheville has appointed Charles T. Westcott, of Baltimore, and Thomas J. Jerome, of Salisbury, N. C., receivers for this company. There are $46,000 bonds outstanding, and a floating debt of about $30,000. The receivers are directed to continue operations at the mine. It is probable that the company will be reorganized.

Oklahoma

OTTAWA COUNTY

Ore has been struck at Narcissa, south of Miami, and three drills are at work. This is virgin territory and south of any ore yet found.

South Dakota

CUSTER COUNTY

Old Charley—The Ruberta Mining Company is about to resume work on this property and is remodeling the 10-stamp mill, with cyanide and roasting additions. Ore will be treated by fall.

LAWRENCE COUNTY

American Flag—The mill has been reconstructed, and fitted with a Dorr classifier and new slimes plant. The present capacity is 200 tons per day.

Gilt Edge Maid—This company has made a long lease of some water-rights which were involved in litigation, which is ended by the new agreement.

Gold Queen—A large orebody is being opened up in the tunnel, which is now 40 ft. in. The grade appears to be better than in the older workings.

Mogul—Production has been curtailed in this mine, owing to the burning of the Horseshoe hoist. A new hoist is now being erected at the mine.

Connie May Morris—Work will be resumed on the property by the Nebraska Mining Company, and a diamond drill has been started on an incline into the hill to determine the size of the orebody.

Golden Reward—The annual meeting of the company resulted in the election of the old board of directors as follows: F. H. Harriman, August Belmont, O. H. Hahn, Harris Franklin, C. C. Tegethoff, Robert W. Goelet, George G. DeWitt, Henry W. De Forest and W. B. Devercaux. All except Franklin, whose home is in Chicago, are from New York. The company will reopen the Las Animas mine for shipments.

Hailstorm—A new orebody 35 ft. wide is being developed. It contains free gold.

Hercules—This company is preparing to commence work on a 100-ton mill to treat a body of shale ore being developed in one of the shafts. This ore runs from $4 to $12 per ton in gold. The richer ore is now being sacked and shipped outside.

Mogul—The old Hardscrabble mine in the Terry district will be reopened, and shipment made to the mill at Pluma. The Lucile is also to become a producer again after some idleness.

Roenna—The tunnel is now in 185 ft., and some good ore has been encountered. The ore runs from 80c. to $5 per ton gold. Ohio capital owns the property, which consists of 300 acres in the Tinton district.

Texas

PRESIDIO COUNTY

A large tract of coal land has been sold to J. H. Adams, of Kansas City, Mo., who intends to begin development work at once.

Utah

CARBON COUNTY

Consolidated Fuel Company—This company intends to begin shortly the construction of 18 miles of railroad to connect its mines at Miller Creek with the main line of the Denver & Rio Grande railroad.

JUAB COUNTY

Godiva—Development work is progressing steadily in this property, which was recently revived by the reorganization of the company. The shaft is being sunk to the 1300 level, the depth being about 950 ft. at present.

SALT LAKE COUNTY

Mt. Aetna—This property, which is located in Bingham, has been bonded to a strong Boston syndicate, which will organize a new company and undertake its development. The group consists of about a dozen claims, five of which are patented.

Silver King—This property, at Alta, is on a shipping basis. It was recently purchased by interests largely identified with the Columbus Consolidated company.

Utah Copper Company—A quarterly statement was issued, Aug. 1, the substance of which is as follows: The new Garfield plant was started up late in June, 1907. The capacity of this plant is 6000 tons per day, and is comprised in 12 complete sections of 500 tons each. The first two sections were started in regular operation July 1; the third and fourth sections July 15; the fifth section, Aug. 17; the sixth, Sept. 1; the seventh, Nov. 2; the eighth, Dec. 18, 1907; the ninth, March 20, 1908; the 10th, May 1. The 11th section is in operation Aug. 1, and the 12th, probably 60 days thereafter. For the quarter ending June 30, the gross production of copper amounted to 11,568,390 lb. The average cost for the quarter was 8.16c. per lb. on the net copper resulting after allowing smelter deductions. Total gain for quarter, $493,694. The earnings for the quarter are based on 12½c. copper for April and May, and on 12¾c. copper for June, although the copper sold during this period brought prices slightly in excess of the average of these figures. At the present time the company has no finished copper on hand unsold. The directors expect a gradual improvement in results and profits as steam-shovel operations progress. Up to the present time it has been impossible to avoid mining and milling a considerable amount of surface oxidized material owing to the conditions surrounding mining and stripping operations. The production for the 12 months ending June 30 shows an increase for each quarter as follows: First quarter, July, 5,305,368 lb.; second quarter, 7,716,712; third quarter, 8,527,939; fourth quarter, 11,568,390; total, 33,118,409 lb. During the quarter just ended 34 per cent. of the ore came from underground mining, by the caving system, and 66 per cent. from steam-shovel operations. The company will have, on Oct. 1, approximately $2,000,000 available for working capital and the commencement of the payment of dividends.

SUMMIT COUNTY

Park City Ore Shipments—Last week shipments amounted to 1856 tons, the mines contributing and amounts being: Daly-Judge, 484; Silver King Coalition, 858; Daly-West, 500; miscellaneous, 12 tons.

Boulder Basin—This property, near Park City, has been bonded to a Salt Lake syndicate, for $30,000 consideration.

West Virginia

FAYETTE COUNTY

MacAlpin Coal Company—This company has been organized by James M. Laing, of Charleston, and others, to open a coal mine on a tract recently bought near Thurmond.

MCDOWELL COUNTY

Reed Coal and Land Company—This company is preparing to open a mine on its coal land near Avondale. L. B. Tussing, Columbus, O., is president.

MARION COUNTY

George's Creek Coal and Iron Company—This company has arranged to sink an additional shaft near its present mine at Farmington. J. J. Alexander, Equitable building, Baltimore, is president.

Canada

BRITISH COLUMBIA—CROW'S NEST PASS

The forest fires in the Kootenay region still continue, but their course has turned

away from the mining section and passed into a country which is almost uninhabited. Account is being taken of the damage done, but is still incomplete. The towns of Michel and Coal Creek, with the mines there, were saved, though badly damaged. The Crow's Nest Pass Coal Company has taken prompt steps to replace the surface plant destroyed at Fernie. Material for a steel tipple, larger than the one destroyed, has been ordered in Cleveland, Ohio; and other machinery has been ordered, so that the mines may be in operation as soon as possible.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore for the week ending Aug. 1 were as follows: City of Cobalt, 42,210 lb.; Drummond, 63,300; La Rose, 285,040; Nipissing, 120,600; Nancy Helen, 40,000; Right of Way, 121,100; Silver Leaf, 61,410; Trethewey, 170,250; Watts, 54,630. Total, 1,022,330 pounds.

Cobalt Central—A vein 8 in. wide, carrying about 5000 oz. silver to the ton, has been struck on the second level of the property leased by this company.

Drummond—Eight drills and 75 men are at work under the direction of Superintendent Brigstock. Four shafts on the 40 acres near Kerr lake have been sunk to the respective depths of 20, 35, 100 and 135 ft. and 1700 ft. of underground development has been done. Six veins have been encountered on the property.

ONTARIO—TEMAGAMI RESERVE

Van Nostrand Township—In the course of assessment work on a group of claims held by a Toronto syndicate, a number of veins varying from 3 to 15 in. in width and carrying iron carbonates and silver have been found. From one vein 4 in. wide a number of small silver nuggets were taken.

ONTARIO—PORT ARTHUR DISTRICT

Beaver—A carload of ore was shipped last week for treatment in American refineries. A concentration mill is being installed and is expected to be completed this month.

ONTARIO—STURGEON LAKE DISTRICT

Fawcett and Bouillon—Five gold claims, belonging to prospectors named Fawcett and Bouillon, have been purchased by W. F. Brunnea, acting on behalf of Paul A. Fuse, St. Louis, and D. Jenkower, New York, for $25,000. The property was held on option for some time and development operations gave a good showing of gold.

NOVA SCOTIA

Dominion Iron and Steel Company—For the first five days of July the furnaces were idle. The output for the remainder of the month amounted to 22,080 tons of steel, which included 16,405 tons of rails, and 2503 tons of rods in addition to blooms and billets.

Mexico

CHIHUAHUA

American Smelting and Refining Company—A third furnace is being made ready for blowing in at this company's new smeltery near Chihuahua, and the installation of two additional furnaces is also planned. The plant has been in successful operation for several weeks, and increased ore receipts insure uninterrupted operations.

Parral Shipments—The production of the Parral camp for the week ending July 25 amounted to 7550 tons, of which 3970 tons were treated at local milling plants and the remainder sent to outside smelters. Among recent new shippers is the San Jose.

Veta Colorada—It is reported that as a result of the late visit of large stockholders to this company's properties in the Parral camp the work of completing the 500-ton cyanide plant may be resumed at an early date.

Sierra Plata—This company is contemplating the the early installation of hoisting and pumping machinery of large capacity at its property in the Minas Nuevas camp out from Parrel. R. H. Allen is the manager in charge.

Uruachic—Renewed mining and prospecting activity are noted in this section reached from Creel. The present operative properties include the San Mateo, San Martin, San José, Santa Rosa, Almalinda, Santa Marguerita and Mexican Mines Syndicate. Development work is in progress at the San Mateo and plans are under way for the erection of a matting plant; the San Martin is already equipped with modern hoisting, concentrating and smelting works, all of which may be put in operation shortly; at the San José a 10-stamp mill is in commission; the Mexican Mines Syndicate has plans for the operation of a custom smeltery near the town of Uruachic; the Almalinda is new property of promise under development. With the extension of the Orient railway line to Los Tascotes this camp can be reached in one day's travel.

Greene Gold-Silver Company—This company has suspended operations at its Matulera mine near Ocampo. It is given out that this action is necessitated by the pending merger of this property with that of the old Belen Gold Mining Company's holdings in the same district. The Sierra Land and Lumber Company, another Greene enterprise, has also suspended lumbering operations at its immense Madera sawmill plant. Considerable interest is manifested as to whether Colonel Greene, who lately went to Japan for his health, will be able to secure from the Federal Government an extension of his mining concession over the 3,000,000-acre tract in the western part of this State; this concession is said to expire in December of this year.

Florencia—Shipments of ore are now sent out from this mine in the Santa Eulalia camp. The owning operators are S. G. Burns and R. J. de Morambert. The superintendent is W. W. Mitchell.

Dos Abril—This company, operating in the Dolores section, lately made a successful trial run of its amalgamation plant, and will shortly inaugurate continuous milling operations. A 30-horse-power steam hoisting plant is now en route to the mine, and on its installation deeper developments will be prosecuted. It is also likely that a concentrating equipment will be added during the next 12 months. This is a Cleveland, Ohio, company. C. Riddle is directing the mining operations.

Santa Eulalia-Union—Considerable ore of mining grade is reported opened up at a depth of about 350 ft. in this company's property in the Santa Eulalia camp. W. Henderson is in charge.

Swastika—Lead-silver ores are being developed at this company's mines in the San Pedro district in the northern part of the State, along the line of the Sierra Madre & Pacific. The properties include the Viernes Santos, El Campo and San Andres denouncements adjoining the old Congreso mine of the Candelaria Mining Company.

Africa

RHODESIA

Gold production in June is reported at 53,426 oz., an increase of 238 oz. over May. For the six months ended June 30 the total was 304,509 oz., or $6,294,201. For the corresponding period in 1907 the total was 292,775 oz., but the reports last year were made in ounces of bullion, while since Jan. 1 last the companies have reported fine gold.

TRANSVAAL

Gold production in the Transvaal in July is reported at 584,455 oz. fine, which is 9482 oz. more than in May, and exceeds by 929 oz. the report for December last, which has been heretofore the record for a single month. For the seven months ended July 31 the total was 3,671,443 oz. fine in 1907, and 3,984,412 oz.—or $82,357,796—in 1908; an increase of 312,969 oz., or 8.5 per cent., this year.

South America

BRITISH GUIANA

Gold exports for the six months ended June 30 were 34,849 oz. bullion in 1907, and 31,343 oz. in 1908; a decrease of 3506 oz. The bullion reported this year was equal to $554,169, or 26,811 oz. fine gold.

Diamond exports this year were 1565 carats, of $10,842 value.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Aug. 12—The coal trade in the West is again showing some signs of improvement in demand. Mines are running on better time in some districts, and shipments have been larger. There seems to be rather more call for steam coal. The improvement is gradual, but operators find encouragement.

The Lake coal trade has been rather disappointing. Up to Aug. 1 the coal passing through the Sault Ste. Marie canals was 1,555,000 tons less than last year; and there has been also a decrease in shipments to Lake Michigan points.

The Seaboard bituminous trade continues dull, with light demand and low prices. The coastwise shipments are still light, though the season is advancing.

Anthracite trade is not active. The July shipments were the smallest of the year, showing a decrease of 1,127,528 tons from last year. Notwithstanding this fall, the supplies seem to be abundant.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Aug. 1, in short tons:

	1907.	1908.		Changes.
Anthracite.....	3,332,392	3,022,542	D.	309,850
Bituminous.....	22,410,402	18,827,072	D.	3,583,330
Coke.....	8,261,428	3,930,328	D.	4,331,100
Total.....	34,004,222	25,779,942	D.	8,224,280

Total decrease this year to date was 24.2 per cent.

Coastwise shipments of coal from Atlantic ports for the five months ended May 31, long tons:

	Anthracite.	Bitum.	Total.	PerCt.
New York....	6,826,362	4,077,112	10,903,474	64.8
Philadelphia	965,725	1,836,264	2,801,989	16.6
Baltimore....	111,421	1,493,242	1,604,663	9.5
Newp't News	.....	981,678	981,678	5.8
Norfolk.....	.....	551,392	551,392	3.3
Total.....	7,903,508	8,939,688	16,843,196	100.0
Total, 1907.	8,235,248	9,431,641	17,666,889	.....

New York includes all the New York harbor shipping ports. The total decrease this year was 823,693 tons, or 4.7 per cent.

Bituminous coal and coke shipments, Pennsylvania and West Virginia, five months ended May 31, short tons:

	Coal.	Coke.	Total.
Balt. & Ohio.....	8,133,749	1,059,969	9,193,718
Buff., Roch. & Pitts.	2,226,987	157,110	2,384,097
Penn. lines, N. Y. C.	2,613,317	27,854	2,641,171
Pitts. & L. Erie.....	2,422,111	1,038,610	3,460,721
Norfolk & Western.	3,865,903	752,754	4,618,657
Total.....	19,262,067	3,036,297	22,298,364
Total, 1907.....	25,525,605	6,032,026	31,557,631

In addition the Baltimore & Ohio carried 461,484 tons anthracite in 1907, and 346,283 in 1908; decrease, 115,201 tons.

Coal tonnage of roads in Ohio Coal Traffic Association, five months ended May 31, short tons:

	1907.	1908.		Changes.
Hocking Valley.....	1,448,839	852,546	D.	596,293
Toledo & Ohio Cent..	681,625	370,909	D.	310,716
Baltimore & Ohio....	862,371	596,035	D.	266,336
Wheeling & L. Erie..	1,414,308	991,397	D.	422,911
Cleve., Lorain & Wh.	1,073,918	938,152	D.	135,766
Zanesville & Western	625,374	407,271	D.	218,103
Toledo Div., Pen. Co.	1,032,828	636,230	D.	396,598
L. Erie, Alliance & Wh.	504,556	385,129	D.	119,427
Marietta, Col. & Clev.	8,920	23,778	I.	14,858
Total.....	7,652,739	5,201,447	D.	2,451,292

The total decrease shown this year is 32 per cent.

Coal receipts at St. Louis, five months ended May 31, were 3,107,946 short tons in 1907, and 2,674,383 in 1908; decrease, 433,563 tons.

Shipments of anthracite from Buffalo by Lake for the season to Aug. 1 were 1,739,915 tons. The larger shipments were 599,825 tons to Chicago; 498,235 to Duluth and Superior; 307,550 to Milwaukee.

Anthracite coal shipments in July were 4,541,506 long tons, a decrease of 1,127,518 tons from July, 1907. For the seven months ended July 31 the shipments were, in long tons:

	1907.	1908.		Changes.
Reading.....	7,933,524	6,953,684	D.	979,840
Lehigh Valley....	6,585,105	6,325,815	D.	259,290
N. J. Central.....	5,044,968	4,892,898	D.	152,070
Lackawanna.....	5,982,905	5,925,177	D.	57,728
Del. & Hudson....	3,778,458	3,733,067	D.	45,391
Pennsylvania	3,532,652	3,428,395	D.	104,257
Erie.....	4,170,458	4,274,567	I.	104,109
N. Y., Ont. & West.	1,578,195	1,676,345	I.	98,150
Total.....	38,606,265	37,209,948	D.	1,396,317

The total decrease for the eight months was 3.6 per cent. Two companies—the Erie and the New York, Ontario & Western—show increases. Six companies show decreases, the largest proportional loss being on the Philadelphia & Reading, and the smallest on the Delaware, Lackawanna & Western.

Coal passing through the Sault Ste. Marie canals for the season to Aug. 1 was, in short tons:

	1907.	1908.		Changes.
Anthracite.....	632,335	643,633	I.	11,298
Bituminous....	4,880,486	3,325,818	D.	1,554,668
Total.....	5,512,821	3,969,451	D.	1,543,370

Total decrease, 28 per cent. The movement began late this season.

New York

Anthracite

Aug. 12—There is no life in the hard-coal market either for prepared or small steam sizes. The slight activity which was apparent last week is not in evidence at present. Independent dealers are cutting circular prices for prepared sizes 15@20c. per ton. Quotations by the large dealers are as follows: Broken, $4.65; egg, stove and chestnut, $4.90; pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2, or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor.

Bituminous

The soft-coal trade is spotty, and improvement is seen only at a few points. In New England and along the Sound certain consumers are taking coal, but consumption is not general; in the far East a few consumers are taking advantage of the low freight rates, but so far the bulk of the requirements has not been contracted for.

In New York harbor the market is at a standstill, and prices are lower than ever. Fair grades of Somerset coal are being offered at $2.25, and good Clearfield coal fetches $2.35. A peculiar feature of the situation is that for the first time in months there is a slight car shortage on at least two roads. It is believed that this condition may have been brought about by the railroads for the purpose of stimulating demand. In the Coastwise vessel trade small vessels are scarce except in New York harbor. Freight rates are firmer and are as follows for large vessels from Philadelphia: To Boston, Salem and Portland, 50@55c.; Lynn, 60@65c.; Newburyport, Gardiner and Bangor, 70@75c.; Portsmouth, 55@60c.; Saco, 90@$1; to the Sound, 45@50 cents.

Birmingham

Aug. 10—Coal production in Alabama shows a little improvement, as new labor is being brought in to take up the work left by the union and other miners on strike. The military force in the mining district has been increased by the bringing in of a regiment more of troops from the southern part of the State. The immediate needs of the furnace companies are being supplied now, together with what coal and coke is being brought in from Tennessee and Virginia. The operators have perfected a strong organization and declare their intentions of operating mines on the open-shop plan. They will listen to no suggestions of arbitration, saying there is nothing to arbitrate. The union miners say they have funds and mean to keep up the fight through the summer. There have been some disorders, and some bushwhacking has been perpetrated.

Chicago

August 11—Harvesting trade continues active in the coal market; otherwise the business is dull. The demand from the West and Northwest increases and is for high-grade coals, threshers having apparently learned by experience the futility of buying low-grade fuel. Some country dealers are stocking up also on domestic supplies.

Illinois and Indiana coals, the chief supply and demand outside of contracts, are the same as last week—$1.75@2.25 for lump, $1.60@1.75 for run-of-mine and $1.35@1.50 for screenings. The demand for lump increases and the demand for fine coals decreases relatively with the growing consumption in the harvesting trade. Steam needs are increasing slowly and the domestic consumers are laying in more coal for the winter.

Of Eastern coals Hocking continues the steadiest, with the best coal holding well up to $3.15, but other prices ranging 10@25c. lower. Youghiogheny is in light supply and demand outside of contracts but brings steadily $3.15 for gas and $3.25 for ¾-in. steam. Smokeless lump is still scarce and run-of-mine brings $3.05@3.30; much low-grade smokeless being on the market. Anthracite is ragged, some country dealers finding good sale, but most inclined not to purchase until actual needs bring quick sales to consumers.

Indianapolis

Aug. 10—Officials in charge of traffic in this State speak cheerfully of the outlook for a heavy fall traffic. They say the worst has been passed, and from now on there will be an increased movement in coal. The railroads are preparing to handle this traffic promptly, and the records of the mines during the past week indicate that it is being offered. The Little Giant mine, near Linton, the Crown Hill No. 2, the Deering mines, near Clinton, and other mines in the State operated full time.

Pittsburg

Aug. 11—Production of coal at the railroad mines in the Pittsburg district shows no gain and is estimated to be at the rate of about 60 per cent. of the capacity of the mines. The independent mines seem to be doing better than the leading producer. Prices continue firm on the basis of $1.15 for mine-run coal at mine. The river mines have slowed up considerably, owing to the heavy accumulation of stock in the pools and in the harbor. The estimated amount ready to go out as soon as the rivers become navigable is 20,000,000 bush. Two rises have been expected within the past two weeks, but fell short by about one foot.

Connellsville Coke—Some fairly large sales have been made during the past week at unusually low prices. One producer, who had fully 500 cars of furnace coke, was compelled to dispose of it yesterday and the price accepted was $1.40. This, however, did not make the market, although other sales have been made at nearly that price for spot shipment. The large interests will not quote less than $1.65 for furnace coke and most of them will not take less than $1.75 either for spot or on contract. The H. C. Frick Coke Company continues to increase its capacity, but its product goes entirely to plants of the United States Steel Corporation. Foundry coke is in good demand and while prices are not particularly strong it is impossible to do less than $2.10 on contract. The *Courier* in its weekly summary gives the production in both of the Connellsville regions at 189,423 tons. The shipments for the week amounted to 7371 cars as follows: To Pittsburg, 3134; to points west of Connellsville, 3720; to points east of Connellsville, 517 cars.

Foreign Coal Trade

Imports and exports of fuel in Germany, six months ended June 30, metric tons:

Imports:	1907.	1908.	Changes
Coal	5,780,078	5,559,354	D. 220,724
Brown coal	4,341,279	5,432,288	I. 91,009
Total coal	10,121,357	9,991,642	D. 129,715
Coke	242,753	258,576	I. 15,823
Briquets	83,765	94,133	I. 10,368
Exports:			
Coal	9,585,270	9,838,175	I. 252,905
Brown coal	9,836	13,328	I. 3,492
Total coal	9,595,106	9,851,503	I. 256,397
Coke	1,803,503	1,812,642	I. 9,139
Briquets	577,370	802,463	I. 225,093

Coke exports this year included 8847 tons to the United States. Imports of peat fuel this year, 6040 tons; exports, 10,386 tons.

French Coal Output—Production of coal in the two chief districts of France, half-year ended June 30, metric tons:

	1907.	1908.	Changes.
Nord	3,372,547	3,412,323	I. 39,776
Pas-de-Calais	8,548,921	8,932,823	I. 393,902
Total	11,921,468	12,345,146	I. 423,678

The coke made was 900,823 tons, a decrease of 63,038 tons; briquets made, 640,073 tons, an increase of 64,139 tons.

Iron Trade Review

New York, Aug. 12—No notable changes have occurred in the market, though there is some increase in business claimed. In pig iron there have been more inquiries reported, but prices are still unsettled, and shading to secure orders does not seem ended yet. Most of the inquiries are for foundry iron, though some basic is called for.

The only activity in finished material is in structural steel, and that is only moderate. New building projects are coming forward more freely, and there is a good deal of negotiating. The prices offered by some construction companies indicate that they expect to get the steel at less than present quoted prices. Some small orders for steel rails are reported, including 10,000 tons for the Chesapeake & Ohio, and 28,000 tons for the Cananea, Yaqui & Pacific in Mexico.

Pig Iron Production—The reports of the furnaces on Aug. 1 show 161 anthracite and coke stacks in blast, having a total weekly capacity of 284,600 tons; an increase of 20,100 tons over July 1. Taking the *Iron Age* estimates for July, with an allowance for the charcoal furnaces, the production for that month was 1,235,000 tons. Added to the American Association report for the first half-year, this gives a total for the seven months ended July 31 of 8,153,004 tons of pig iron.

Lake Superior Iron Ore—Shipments of iron ore from the Lake Superior region in July were 4,364,283 long tons. For the season to Aug. 1 the *Marine Review*, of Cleveland, gives the shipments by ports as follows:

	1907.	1908.	Changes.
Escanaba	2,812,879	754,293	D. 2,058,586
Marquette	1,349,805	345,789	D. 1,004,016
Ashland	1,707,107	592,939	D. 1,114,168
Superior	3,081,664	1,111,887	D. 1,969,777
Duluth	5,151,365	2,819,934	D. 2,331,431
Two Harbors	3,431,921	1,610,439	D. 1,821,482
Total	17,534,741	7,235,281	D. 10,299,460

No change in the situation is probable. The mines are not prepared to rush shipments nor are receiving docks in condition to take care of a large flow of ore. Contract vessels are taking care of all the ore that is offered, wild boats finding no charters.

Baltimore

Aug. 10—Exports for the week included 1,103,969 lb. tin scrap to Rotterdam; 1571 tons steel billets to Liverpool; 5207 tons steel rails to Tampico, Mexico. Imports included 6250 tons manganese ore from India.

Birmingham

Aug. 10—Alabama pig-iron manufacturers are again enjoying a steady demand, and prices have taken on some strength. The lowest quotation now is $12 per ton, No. 2 foundry, with $12.50 a popular price. The sales are aggregating well. The Alabama Consolidated Coal and Iron Company will be making iron from another furnace in the next day or two. Three other furnaces in the district will shortly be started up. Inquiry for iron is coming from all directions. The last week in July was a lively one and the first week of August has been satisfactory. Stocks on hand are moving out, and the home consumption is healthy. The Sloss-Sheffield company will this week start up Lady Ensley furnace at Florence.

Cast-iron pipe plants in the Birmingham district are working on full time, and all

pits are employed. The steel plant at Ensley is busy.

Chicago

August 11—Except for an occasional large lot, buying of pig iron continues to be in small quantities and for immediate needs. Yet the condition of the market, according to leading sellers, is improving. The size of lots is slowly increasing and the disposition of the melter is to buy more slowly, it is true, but surely. Several transactions concern lots of 500 to 1000 tons, and one notable transaction of the last week has been for 15,000 tons. The interest of melters in contract requirements for the first half of next year is growing also; inquiries are notably larger in number and aggregate tonnage.

On Southern iron the price has not been seriously cut below the $12 Birmingham ($16.35 Chicago) adhered to by most representatives of Southern furnaces. Some lots have been placed at $11.50 but they have been under conditions favorable to the seller. The tendency of prices seems to be slightly upward. Lots are running 100 to 500 tons. Northern iron is steady, contract requirements absorbing nearly all the product and odd lots being available at $17@17.50 on last-half deliveries. Charcoal iron brings about $20.50, with sales light.

Iron and steel products are improving somewhat, bars, light railroad supplies and structural materials showing improvement. Coke is stationary at $4.90 for the best Connellsville, and other cokes proportionate.

Philadelphia

Aug. 12—More inquiry for pig iron is reported, with some sales of foundry and basic. There is not yet apparent much disposition to buy far ahead, most orders being for immediate or early delivery. Cast-iron pipe foundries are still in the market, but other interests are coming forward slowly. Prices are still weak and rather irregular, but No. 2X foundry may be quoted around $16.25, gray forge at $15, and basic $15 or a little over.

Steel Billets—No change is reported, but some transactions, noted as pending last week, have been closed.

Bars—Store trade shows a little improvement, but no large business is reported.

Plates—Business in plates has been quiet, but some work from steel carbuilders is expected.

Sheets—Sheets are about the same, with a better store and retail trade.

Scrap—Dealers are taking to the woods, as buyers are not willing to pay prices, while the railroads and other large sellers are not ready to come down. Prices are nominal in the absence of actual sales.

Pittsburg

August 11—Pig-iron prices continue to go down, but the steel market shows some improvement. It is slight, however, and the boom expected to develop before this seems to have been sidetracked. Representatives of the large steel interests who had predicted nearly normal conditions before Sept. 1 are hedging, and say now that normal conditions in the iron and steel trade will not materialize before Jan. 1. Orders are coming in satisfactorily, but consumers continue to buy only for immediate requirements. The Republic Iron and Steel Company, which operated its Bessemer plant at Youngstown for three weeks, was forced to close it Aug. 8. As orders have come in since the closing, it expects to start it again Aug. 15. All of the iron plants of the company are running to from 60 to 70 per cent. of capacity. The Carnegie Steel Company is still operating its big Homestead and Duquesne works in this district and the Ohio works at Youngstown to capacity, but all of its other plants that are in operation are running on slow time. The Edgar Thomson rail plant, containing three mills, is not operating to more than 30 per cent. of capacity and this business is on small new orders and on specifications on old contracts. The American Sheet and Tin Plate Company is reducing its tinplate capacity to such an extent that the excuse that the hot mills are getting ahead of the finishing mills is not accepted. An investigation shows that the season is about ended and the demand for tinplate has declined. At the opening of the week the company was only operating 138 of its 242 tinplate mills. The sheet mills, however, are doing rather better than last week.

Pig Iron—The pig-iron trade is the stumbling block in the general market. There is an inquiry in for 4000 tons of malleable and bessemer iron for a contract to be placed by a railroad. It is evenly divided, but the tonnage is not large, as the deliveries are to extend over about eight months. The Oliver Iron and Steel Company came into the market for 3000 tons of gray forge and 1000 tons of standard bessemer several days ago. The contract has not been placed, as the company refuses to pay more than $13.75 for the forge and $15 for the bessemer. The forge price is regarded as fair, as sales at $14 have been made frequently. The $15 rate for bessemer is below cost, as the lowest previous sale was astonishing, being at $15.40, Valley furnace. While standard bessemer is low, foundry and basic continue high, or rather around a basis of $15, Valley furnaces. There has been a time in the iron trade when foundry iron has sold above bessemer, but this was unusual. A local representative of a big Southern iron producer today reported a sale for fourth quarter delivery at $12.50, Birmingham. This would indicate that the Southern makers are well sold up for the year and can afford to quote only good prices.

Steel—There is no shading of prices on either bessemer or open-hearth billets, $25 Pittsburg being quoted for early delivery, but in some instances a higher price has been asked for shipments in the last quarter. Sheet-bars remain at $27.50, delivered, plates at 1.60c. and steel bars at 1.40c.

Sheets—There has been a pronounced increase in the sheet trade and prices are firm at 2.50c. for black and 3.55c. for galvanized, No. 28 gage.

Ferro-Manganese—The price for prompt shipment is being shaded, but for late delivery, $47 is the lowest. For August $45.50 can be done.

Foreign Trade in Iron and Steel

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for June, and the six months ended June 30, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1907.	1908.	Changes.
June	$17,226,259	$11,677,944	D.$5,548,315
Six months	94,191,759	81,305,675	D.12,886,084

Decrease for the six months, 13.7 per cent. Leading items of export for the six months, in long tons:

	1907.	1908.	Changes.
Pig Iron	41,665	20,430	D. 21,235
Billets, ingots & blooms	50,733	63,741	I. 13,008
Bars	48,753	26,727	D. 22,026
Rails	143,089	83,439	D. 59,650
Sheets and plates	67,136	47,599	D. 19,537
Structural steel	65,723	60,788	D. 4,935
Wire	75,425	71,869	D. 3,556
Nails and spikes	29,513	20,453	D. 9,060

Decreases are shown in all items except billets, ingots and blooms.

Iron and Steel Imports—Imports of iron and steel, including machinery, from the United States for June and the six months ended June 30, are valued as follows:

	1907.	1908.	Changes.
June	$3,272,259	$1,759,651	D. $1,512,608
Six months	21,534,646	10,201,886	D. 11,332,760

Decrease for the six months, 52.6 per cent. Leading items of import for the six months, in long tons:

	1907.	1908.	Changes.
Pig iron	327,134	53,551	D. 273,583
Scrap	12,245	2,158	D. 10,087
Ingots, blooms, etc.	7,802	4,956	D. 2,846
Bars	16,957	11,916	D. 5,041
Wire-rods	9,043	5,538	D. 3,505
Tin-plates	30,871	35,929	I. 5,058

The only increase shown here was that in tinplates. The largest decrease was in pig iron.

Iron Ore Movement—Exports and imports of iron ore in the United States for the six months ended June 30 are reported as follows, in long tons:

	1907.	1908.	Changes.
Exports	47,629	59,676	I. 12,047
Imports	609,305	352,182	D. 257,123

Imports of manganese ore for the six months, 95,859 tons in 1907, and 105,232 tons in 1908; increase, 9373 tons.

Metal Market

Gold and Silver Exports and Imports

NEW YORK, Aug. 12.

At all U. S. Ports in June and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
June 1908..	$ 8,626,718	$ 3,409,885	Exp. $ 5,216,833
" 1907..	23,872,140	2,165,342	" 21,706,798
Year 1908..	53,507,975	26,368,198	" 27,139,777
" 1907..	36,300,732	21,468,647	" 14,832,085
Silver:			
June 1908..	4,437,360	3,366,182	Exp. 1,071,178
" 1907..	5,360,599	3,476,546	" 1,884,053
Year 1908..	25,514,545	21,054,332	" 4,460,213
" 1907..	29,219,209	22,395,611	" 6,823,598

Exports of specie from New York, week ending Aug. 8: Gold, $6825, to the West Indies; silver, $969,341, chiefly to London. Imports: Gold, $406,809, chiefly from Cuba and Central America; silver, $75,687, chiefly from Mexico.

Specie holdings of the leading banks of the world, Aug. 8, are reported, as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York	.....	.....	$322,791,700
England	$180,287,180	.....	180,287,180
France	642,442,880	$181,365,940	823,808,820
Germany	188,675,000	78,195,000	266,870,000
Spain	78,375,000	135,450,000	213,825,000
Netherlands	38,520,000	21,294,000	59,814,000
Belgium	20,013,335	10,006,665	30,020,000
Italy	183,555,000	22,000,000	205,555,000
Russia	580,170,000	39,725,000	619,895,000
Aust.-Hungary	235,070,000	66,680,000	301,750,000
Sweden	20,145,000	.....	20,145,000
Norway	8,680,000	.....	8,680,000
Switzerland	20,855,000	.....	20,855,000

The New York banks do not separate gold and silver. The foreign statements are from the *Commercial and Financial Chronicle* of New York.

The Treasury Department estimates the amount and kinds of money in the United States Aug. 1 as follows:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury)	$ 195,752,744	$ 615,788,276
Gold certificates	34,485,260	784,273,609
Silver dollars	4,118,848	75,185,134
Silver certificates	9,363,038	474,690,962
Subsidiary silver	24,222,649	122,782,736
Treasury notes of 1890	13,211	4,889,789
U. S. notes	5,645,634	341,035,382
Nat. bank notes	64,772,332	627,316,659
Total	$338,373,716	$3,045,962,547

Circulation per capita, $34.77. Total amount in circulation Aug. 1 was $505,258 more than on July 1, and $264,638,987 more than on Aug. 1 last year.

Silver Market

SILVER AND STERLING EXCHANGE.

August.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	August.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.
6	4.8650	52 3/8	24 3/16	10	4.8660	52	24
7	4.8660	52 1/8	24 1/16	11	4.8650	51 5/8	23 13/16
8	4.8660	52 1/8	24 1/16	12	4.8660	51 3/4	23 7/8

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

Silver opened this week at 24 3/16d. in London, but with a weak tendency owing to the fact that the Indian bazaars were the only bidders for silver, and offerings were larger than the demand. This induced Indian sales for bear account, and broke the price to 23 13/16d. on Aug. 11. The market closes firm at 23 7/8d. today.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to July 30:

	1907.	1908.	Changes.
India	£7,224,414	£4,997,493	D. £2,226,921
China	.....	516,400	I. 516,400
Straits	544,012	90,510	D. 453,502
Total	£7,768,426	£5,604,403	D. £2,164,023

Receipts for the week were £4000 from the West Indies and £131,000 from New York; £135,000 in all. Exports were £530,000, to India.

Copper, Tin, Lead and Zinc

DAILY PRICES OF METALS.

August.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
6	13 3/8 @13 5/8	13 1/4 @13 1/2	60 7/8	30 3/4	4.57 1/2 @4.62 1/2	4.72 1/2 @4 77 1/2	4.60 @4.65
7	13 1/2 @13 3/4	13 3/8 @13 5/8	61 3/8	30 3/4	4.57 1/2 @4.62 1/2	4.72 1/2 @4.77 1/2	4.60 @4 65
8	13 1/2 @13 3/4	13 3/8 @13 5/8	....	30 3/4	4.57 1/2 @4.62 1/2	4.72 1/2 @4.77 1/2	4.60 @4.65
10	13 3/4 @14	13 5/8 @13 3/4	61 7/8	30 3/4	4 57 1/2 @4.62 1/2	4.70 @4.75	4.55 @4.60
11	13 3/4 @14	13 1/2 @13 3/4	61 1/4	30 3/4	4.57 1/2 @4 62 1/2	4.70 @4.75	4.55 @4 60
12	13 3/4 @14	13 1/2 @13 3/4	60 1/4	30 5/8	4.57 1/2 @4.62 1/2	4.70 @4 75	4.55 @4 60

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b's. The New York quotations for electrolytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—For the first part of the week under review, that is for Aug. 6 and 7, business was very active and sales continued large. On Aug. 8 there was a decline, and on Aug. 10 sales fell off to a small figure, and very little business has been done since, either with domestic users or for export. In well informed circles, the impression prevails that the pace has been somewhat fast, although it is recognized that the present level of prices cannot by any means be considered high. The most urgent demand appears to be satisfied for the time being and the volume of the transactions has shrunk materially. In the absence of business the last two days, there has been no material change in prices. The market closes slightly easier at 13¾@14c. for Lake; 13½@13¾ for electrolytic in ingots, cakes or wirebars. The average at which casting copper has sold during the week is at 13¼@13½ cents.

A large quantity of copper has been sold during the recent activity, both for domestic use and export, for deliveries running up to the end of October. The quantity is variously estimated at 60,000,000 to 75,000,000 lb. Exports for the next two months will be large.

After touching £62 for spot and £63 for three months, a great deal of speculative realization was encountered in the London standard market, which brought about a rapid decline at the close, quotations being cabled at £60 5s. for spot and £61 for three months.

Refined and manufactured sorts we quote: English tough, £64@65; best selected, £64@65; strong sheets, £76@77.

Exports of copper from New York and Philadelphia for the week were 5251 long tons. Our special correspondent gives exports from Baltimore at 1156 long tons of copper.

Manufactured Copper—There has been a general advance. Sheets, cold-rolled, 19c.; hot-rolled, 18c. Wire, 15¼c. base.

Tin—The market moved within narrow limits and is inclined to sag at the close, which is cabled at 137 10s. for spot and £137 15s. for three months.

The demand from this side, which might have had a stimulating influence on prices abroad, was entirely absent. In the home market, the demand from consumers leaves much to be desired. Tinplate and solder manufacturers will now probably remain out of the market for some time to come, as their season is practically at an end. The premium for spot material, which has become more plentiful, is decreasing, and it can be bought at 30⅝ cents.

Visible stocks of tin Aug. 1 were, in long tons:

	In Store.	Afloat.	Total.
London	6,307	4,296	10,603
Holland	1,926	183	2,119
U. S., exc. Pacific ports	1,390	1,850	3,240
Total	9,633	6,329	15,962

The total shows an increase over July 1 of 1807 tons.

The tin output of the Federated Malay States for June is reported at 3827 long tons; for the six months ended June 30 at 24,442 tons, an increase of 1088 tons over last year.

Lead—A fair amount of business is doing from day to day at 4.57½@4.62½c. New York.

The London market, after advancing to £13 15s. for Spanish lead, is easier at the close, quotations being cabled at £13 10s. for Spanish lead and £13 11s. 3d. for English lead.

Spelter—Business has been of small proportions. First hands being well sold out are not pressing spelter for sale; however, there have been some quantities in second hands which have been thrown on the market and which have brought about a decline to 4.70@4.75c. New York, and 4.55@4.60c. St. Louis.

Advices from abroad about the spelter market are most encouraging, and under a large business, prices at the close advanced to £19 15s. for good ordinaries and £20 for specials.

Zinc Sheets—Base price is 7c. f.o.b. La Salle-Peru, Ill., less 8 per cent.

Other Metals

Antimony—Some quiet buying of standard brands for forward delivery has developed. Quotations are 8⅜c. for Cookson's, 8¼c. for Hallett's, and 7⅞@8c. for ordinary brands.

Aluminum—Ingots, American No. 1, in large quantities, 33c. per lb. Rods and wire, 38c. base; sheets, 40c. base. Occasional offers of foreign metal are reported.

Cadmium—In 100-lb. lots, $1.25 per lb., at Cleveland, Ohio.

Nickel—According to size of lot and terms of sale, 45@50c., New York.

Quicksilver—New York price is $44 per flask for large lots; $45 for jobbing orders. San Francisco, large lots nominal at $43.50, domestic and $42, export; small orders, $45@46. London is lower, at £17 17s. 6d. per flask, with 1s. 3d. less quoted by second hands.

Platinum—Prices remain unchanged at $22.50 per oz. for hard platinum, $20 for ordinary and $15 for scrap.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, six months ended June 30, figures in long tons, except quicksilver, which is in pounds:

	Imports.	Exports.	Excess.	
Copper	82,066	31,511	Imp.	50,555
Copper, 1907	55,672	37,970	Imp.	17,702
Tin	22,915	21,034	Imp.	1,881
Tin, 1907	21,348	19,132	Imp.	2,216
Lead	117,512	27,793	Imp.	89,719
Lead, 1907	95,235	25,807	Imp.	69,428
Spelter	53,969	3,810	Imp.	50,159
Spelter, 1907	55,324	2,549	Imp.	52,775
Quicksilver, lb.	2,944,722	849,945	Imp.	2,094,777
Quicksilver, '07	2,803,946	1,131,722	Imp.	1,672,224

Copper totals include metallic contents of ore and matte. Tin ore imports, not given above, 10,610 tons in 1907, and 13,087 in 1908. Imports of iron and copper pyrites, 410,082 tons in 1907, and 435,521 in 1908. Of the imports this year the United States furnished 3314 tons copper matte, 35,892 tons fine copper and 20,201 tons lead. Exports include re-exports of foreign material.

Wisconsin Ore Market

Platteville, Wis., Aug. 8—The base price for 60 per cent. zinc ore this week was $36 per ton; two cars are reported sold on a higher base, but no premium figure is reported. For 80 per cent. lead ore $60 was paid. Some of the accumulated stock of zinc ore held for better prices was sold this week, but not shipped.

Ore shipments, week ended Aug. 8, were:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Highland	555,150	.....	.....
Platteville	388,770	.....	88,000
Hazel Green	203,300	.....	.....
Benton	149,860	84,070	.....
Livingston	100,000	.....	.....
Cuba City	.....	154,240	.....
Strawbridge	.....	54,000	.....
Total	1,397,080	292,310	88,000
Year to Aug. 8	54,622,701	6,677,925	1,086,014

Mineral Point, Linden and Harker failed to report; will be reported next week. In addition to the above there was shipped to the electrostatic separator from Benton, 313,340 lb.; from Elmo, 57,630 lb.; from Rewey, 52,200 lb. Shipped to the Joplin Separator Works, at Galena, from Hazel Green, 79,000 lb.; from Benton, 79,000 lb. Shipped to the Enterprise roaster at Platteville, from Strawbridge, 154,000 lb. zinc ore.

Missouri Ore Market

Joplin, Mo., Aug. 8—The highest price for zinc ore was $39, the base price $35@36 per ton of 60 per cent. zinc, silicate ore from $9 to $20, and the average, all grades, was $32.12 per ton. The highest price offering for lead ore was $63.50 for next week's delivery, with settlements for this week's delivery averaging $60.66, medium grades selling at $60@61 per ton.

Considerable zinc ore that had been accumulating from two to six weeks was shipped out this week, while in some quarters the present week's production was purchased and held for next week's shipment; thus the shipment shows only an increase of 978 tons, lowering the reserve stock approximately 800 tons, and leaving over 6000 tons in the bins, according to estimates made by a representative of the producers.

The highest price for zinc a year ago was $49, the assay base $44@46 per ton of 60 per cent. zinc. Lead was $64.50, with medium grades at $58@62 per ton.

Following are the shipments from the district for the week ending Aug. 8:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,131,420	890,970	$78,842
Joplin	2,611,260	213,400	50,898
Alba-Neck	675,530	.....	11,821
Galena	633,310	58,550	11,768
Prosperity	498,300	94,550	11,104
Oronogo	556,900	.....	9,957
Miami	622,240	56,600	8,543
Duenweg	446,830	27,730	8,115
Badger	364,070	44,460	7,523
Carthage	421,550	.....	7,375
Spurgeon	272,590	103,870	6,183
Granby	307,510	29,850	4,910
Aurora	386,990	9,440	4,485
Carl Junction	164,220	1,170	2,827
Sarcoxie	143,160	.....	2,433
Zincite	146,840	.....	2,422
Ash Grove	.....	44,380	1,331
Cave Springs	62,080	.....	993
Totals	11,444,800	1,572,970	$231,530
32 weeks	295,737,570	46,322,540	$6,237,728

Zinc value, the week, $183,833; 32 weeks., $4,970,757
Lead value, the week, 47,697; 32 weeks., 1,266,971

Average ore prices in the Joplin market were, by months:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1907.	1908.	Month.	1907.	1908.
January	45.84	35.56	January	83.58	46.88
February	47.11	34.92	February	84.58	49.72
March	48.66	34.19	March	82.75	49.20
April	48.24	34.08	April	79.76	52.47
May	45.98	33.39	May	79.56	56.05
June	44.82	32.07	June	73.66	60.48
July	45.79	31.67	July	58.18	59.90
August	43.22	.....	August	59.54	.....
September	40.11	.....	September	53.52	.....
October	39.83	.....	October	51.40	.....
November	35.19	.....	November	43.40	.....
December	30.87	.....	December	37.71	.....
Year	43.68	.....	Year	68.90	.....

Chemicals

New York, Aug. 12—The general market is unchanged, but along certain lines, such as heavy chemicals and acids, a better tone prevails, and some business has been done for future delivery.

Copper Sulphate—The strength in the copper-metal market has had its effect upon this by-product. Prices are firm at $4.65 per 100 lb. for carloads, and up to $4.90 for smaller lots.

Nitrate of Soda—Messrs. Mortimer & Wisner, New York, report the position of nitrate in the United States Aug. 1 as follows, in long tons:

	1907.	1908.	Changes.	
Stocks, Jan. 1	13,050	5,900	D.	7,150
Imports, 7 months	163,745	142,450	D.	21,295
Total Supplies	176,795	148,350	D.	28,445
Deliveries, 7 months	170,670	134,850	D.	35,820
Stocks, Aug. 1	6,125	13,500	I.	7,375
Afloat for U. S.	110,000	85,000	D.	25,000

Quantities afloat include all cargoes due to arrive by Nov. 15 at United States ports.

Phosphates—Messrs. J. M. Lang & Co. report the exports of Florida phosphate rock through the port of Savannah in July: Great Britain, 537 tons; Germany and Holland, 3554; total, 4091 tons.

Mining Stocks

New York, Aug. 12—A strong and excited bull market on the Stock Exchange has been the rule during the past week, with only very slight reactions, which hardly interrupted the upward course of quotations. The amount of business has been larger than for months past.

Amalgamated Copper touched $83.50; American Smelting common, $110; Utah Copper, $46.50; United States Steel, $48 for the common, and $110 for the preferred. Other stocks showed parallel advances.

On the curb market also there was great activity and many advances, with occasional reactions. Nevada Consolidated passed $17, and Cumberland-Ely, $10.50. Butte Coalition sold over $28, and Miami above $10. Some stocks which have hardly been heard of lately—such as United Copper—were taken up and made advances.

Today showed a sharp reaction in the

copper stocks, both in prices and in the amount of trading. Apparently this is only a temporary lull in the advance.

Boston

Aug. 11—The mining-share market continues broad and active, with just enough reaction in prices at times to solidify it. At present the market is in a reactionary period. Prices, as compared with a week ago, are higher in cases and lower in others. The high-grade stocks show little or no change. It is estimated that there has already been an appreciation in some 30 copper-mining shares since the low of 1907 of almost $285,000,000.

Amalgamated touched $83.25, but reacted to $80.87½ today. Butte Coalition, from high at $30, is off to $27.12½. Copper Range has been an active feature. Touching $81.50, it has reacted to $79.50, a small net loss for the week. North Butte reached $86, and is off to $83.50. Trinity, under Lawson patronage, made a $7 spurt, touching $25, from which it reacted to $19.50. United Copper, on speculative buying, rose $6.25 to $14. Centennial recorded a $3.50 rise to $33.50. Adventure touched $9.50; Mass, $8; U. S. Smelting, $44.62½; Superior Copper, $25.75, and Utah Copper rose from $40 to $46.25.

A new flotation is that of the North Lake Mining Company, 100,000 shares, at $8 per share. Subscriptions are being received here as well as in Michigan. It is located north of the Lake property, and is said to have the Lake lode for a considerable distance.

STOCK QUOTATIONS

NEW YORK Aug. 11	
Name of Comp.	Clg.
Alaska Mine	5/8
Amalgamated	80½
Anaconda	48⅝
Balaklala	2
British Col. Cop.	7⅝
Butte & London	....
Butte Coalition	27⅝
Colonial Silver	.25
Cum. Ely Mining	9⅝
Davis Daly	3⅛
Dominion Cop	2⅜
Douglas Copper	4¼
El Rayo	3 1/16
Florence	3 7/16
Foster Cobalt	.44
Furnace Creek	.26
Giroux	4¼
Gold Hill	⅝
Goldfield Con	6 1/16
Granby	‡105
Greene Gold	3/16
Greene G. & S	.25
Greenw'r & D.Val.	.75
Guanajuato	2⅛
Guggen. Exp.	178
Hanapah	‡.20
McKinley Dar.	7/16
Micmac	3
Mines Co. of Am.	1 1/16
Mitchell Mining	1½
Mont. Sho.C	1 1/16
Nev. Utah M. & S	4
Newhouse M. & S	6⅞
Nipissing Mines	7¾
Old Hundred	7/16
Silver Queen	1.05
Stewart	1
Tennessee Cop'r.	39¼
Tri-Bullion	2½
Union Copper	1 1/16
Utah Apex	4⅛
Utah Copper	44½
Yukon Gold	5 1/16

BOSTON Aug. 11	
Name of Comp.	Clg.
Adventure	8⅞
Allouez	38¼
Am. Zinc	28¾
Arcadian	4¾
Arizona Com	22½
Atlantic	14¾
Bingham	.75
Boston Con	14
Calumet & Ariz	127¾
Calumet & Hecla	690
Centennial	32½
Con. Mercur	.45
Copper Range	79½
Daly-West	‡11
Franklin	13
Greene—Can.	12
Isle Royal	22½
La Salle	14½
Mass	7⅛
Michigan	13½
Mohawk	‡68¾
Nevada	15⅞
North Butte	83½
Old Colony	.80
Old Dominion	41
Osceola	116
Parrot	28¼
Quincy	96
Rhode Island	4½
Santa Fe	2
Shannon	15⅞
Superior	24⅜
Tamarack	75
Trinity	20
United Cop., com.	12⅝
U. S. Oil	26½
U. S. Smg. & Ref.	44
U.S.Sm. & Re.,pd.	45¾
Utah Con	48½
Victoria	6
Winona	7
Wolverine	145
Wyandotte	2¼

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	25¾
Am. Smelt. & Ref.	99⅞
Am. Sm. & Ref., pf.	109
Bethlehem Steel	22
Colo. Fuel & Iron	35¾
Federal M. & S., pf.	87
Inter. Salt	18½
National Lead	86¾
National Lead, pf.	‡104
Pittsburg Coal	12¼
Republic I. & S.	24½
Republic I. & S., pf.	80½
Sloss-Sheffield	63½
Standard Oil	647
U. S. Red. & Ref.	‡15¼
U. S. Steel	46¾
U. S. Steel, pf	109¼
Va.-Car. Chem	29½

BOSTON CURB	
Ahmeek	184
Black Mt.	‡3¾
East Butte	8½
Hancock Con.	‡6¾
Keweenaw	7/16
Majestic	.78
Raven	1 1/16
Shawmut	.34
Superior & Pitts.	14¾
Troy Man	‡.45

ST. LOUIS Aug. 8		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.05	.03
Center Cr'k	2.00	1.50
Cent. C. & C.	68.00	67.00
C.C. & C. pd.	78.00	76.00
Cent. Oil	110.00	100.00
Columbia	5.00	4.00
Con. Coal	20.00	17.00
Doe Run	125.00	110.00
Gra. Bimet.	.20	.18
St. Joe	15.00	13.00

LONDON Aug. 12			
Name of Com.	Clg.		
Dolores	£1	10s	0d
Stratton'sInd.	0	1	0
Camp Bird	0	13	3
Esperanza	3	9	0
Tomboy	1	2	6
El Oro	1	6	3
Oroville	0	9	4½

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Aug. 12.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.20
Belcher	.20	St. Ives	.32
Best & Belcher	.25	Triangle	06
Caledonia	.13	BULLFROG STOCKS	
Challar	.17	Bullfrog Mining	.03
Comstock	‡.26	Bullfrog Nat. B	.05
Con. Cal. & Va	.78	Gibraltar	.06
Crown Point	.28	Gold Bar	.04
Exchequer	.25	Homestake King	.34
Gould & Curry	.14	Montgomery Mt.	.08
Hale & Norcross	.24	Mont. Shoshone C.	1.00
Mexican	.76	Original Bullfrog	.02
Ophir	2.10	Tramp Cons	.18
Overman	.08	MANHAT'N STOCKS	
Potosi	.08	Manhattan Cons.	.08
Savage	.24	Manhat'n Dexter	.04
Sierra Nevada	.29	Jumping Jack	.02
Union	.27	Stray Dog	.03
Utah	.04	MISCELLANEOUS	
Yellow Jacket	.56	Golden Boulder	.07
TONOPAH STOCKS		Bonnie Clare	.07
Belmont	1.18	Lee Gold Grotto	...
Extension	.88	Nevada Hills	1.67½
Golden Anchor	.02	Nevada Smelting	1.00
Jim Butler	.28	Pittsburgh S. Pk.	1.06½
MacNamara	.62	Round Mt. Sphinx	.20
Midway	.42		
Montana	1.50		
North Star	.10		
Tono'h Mine of N.	7.62½		
West End Con	.55		
GOLDFI'D STOCKS			
Adams	.04		
Atlanta	.26		
Booth	.41		
Columbia Mt	.25		
Comb. Frac	1.37		
Cracker Jack	.07		
Dia'dfield B. B. C.	.17		
Goldfield Belmont	.15		
Goldfield Daisy	.76		
Great Bend	.35		
Jumbo Extension	.54		
Katherine	...		
Kendall	.15		
Lone Star	.10		
May Queen	.03		
Oro	.15		
Red Hill	.21		
Roanoke	...		
Sandstorm	.32		

COLO. SPRINGS Aug. 8	
Name of Comp.	Clg.
Acacia	‡6¼
Black Bell	....
C. C. Con	3⅛
Dante	‡6¼
Doctor Jack Pot	‡5
Elkton	59
El Paso	35
Findlay	21
Gold Dollar	‡6
Gold Sovereign	3
Isabella	28½
Index	....
Jennie Sample	‡2⅝
Jerry Johnson	‡4
Mary McKinney	‡25
Pharmacist	‡3
Portland	1.00
Un. Gold Mines	3⅞
Vindicator	85
Work	8¼

Assessments

Company.	Delinq.	Sale.	Amt.
Butler-Liberal, Utah	July 17	Aug. 6	$0.02
Caledonia, Nev	Aug. 12	Sept. 2	0.05
Challar, Nev	July 8	July 30	0.10
Exchequer, Nev	Aug. 11	Sept. 1	0.05
Helvetia, Ariz	.....	July 20	0.50
Ingot, Utah	July 17	Aug. 5	0.01
Iowa Copper, Utah	July 13	July 30	0.05
Lead King, Utah	July 1	July 28	0.01
Little Chief, Utah	Aug. 11	Sept. 1	0.01
Lucky Calumet, Ida	July 3	Aug. 13	0.01
Maxfield, Utah	July 18	Aug. 17	0.02
Mexican, Nev	July 17	Aug. 17	0.10
Missoula Copper, Ida	July 25	Aug. 25	0.01
Oro Cobre, Cal	July 16	Aug. 3	0.02
Sierra Nevada	July 14	Aug. 4	0.10
Signet	Aug. 8	Oct. 6	0.01
Talisman, Utah	Aug. 1	Aug. 18	0.02
Tomahawk, Nev	July 10	Aug. 12	0.01
Wabash, Utah	July 10	Aug. 1	0.10
Wheeler, Utah	July 16	Aug. 6	0.01½

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68.673	55.678	31.769	25.738
February	68.835	56.000	31.852	25.855
March	67.519	55.365	31.325	25.570
April	65.462	54.505	30.253	25.133
May	65.971	52.795	30.471	24.377
June	67.090	53.663	30.893	24.760
July	68.144	53.115	31.366	24.514
August	68.745	.....	31.637	.....
September	67.792	.....	31.313	.....
October	62.435	.....	28.863	.....
November	58.677	.....	27.154	.....
December	54.565	.....	25.362	.....
Year	65.327	.....	30.188	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January	24.404	13.726	24.825	13 901	106.739	62 386
February	24.869	12.905	25.236	13.098	107.356	58.786
March	25.065	12.704	25.560	12 875	106.594	58.761
April	24.224	12.743	25.260	12.928	98.625	58.331
May	24.048	12.598	25.072	12.788	102.375	57.387
June	21.665	12.675	24.140	12.877	97.272	57.842
July	22.130	12.702	21.923	12.933	95.016	57.989
August	18.356	.....	19.255	.....	79.679	.....
September	15.565	.....	16.047	.....	68.375	.....
October	13.169	.....	13.551	.....	60.717	.....
November	13.391	.....	13.870	.....	61.226	.....
December	13.163	.....	13.393	.....	60.113	.....
Year	20.004	.....	20.661	.....	87.007	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	29.207
February	42.102	28.978	August	37.667	.....
March	41.313	30.577	September	36.689	.....
April	40.938	31.702	October	32.620	.....
May	43.149	30.015	November	30.833	.....
June	42.120	28 024	December	27.925	.....
			Av. year.	38.166	.....

Prices are in cents per pound.

LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6.000	3.691	19.828	14.469
February	6.000	3.725	19.531	14.250
March	6.000	3.838	19.703	13.975
April	6.000	3.993	19.975	13.469
May	6.000	4.253	19.688	12.938
June	5.760	4.466	20.188	12.600
July	5.288	4.447	20.350	13.000
August	5.250	.....	19.063	.....
September	4.813	.....	19.775	.....
October	4.750	.....	18.531	.....
November	4.376	.....	17.281	.....
December	3.658	.....	14.500	.....
Year	5.325	.....	19.034	.....

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6.732	4.513	6.582	4.363	27.125	20.563
February	6.814	4.788	6.664	4.638	25.938	20.875
March	6 837	4.665	6.687	4.527	26.094	21.075
April	6.685	4.645	6.535	4.495	25.900	21.344
May	6.441	4.608	6.291	4.458	25.563	19.966
June	6.419	4.543	6.269	4.393	25.469	19.000
July	6 072	4.485	5.922	4.338	23.850	19.031
August	5.701	.....	5.551	.....	21.969	.....
September	5.236	.....	5.086	.....	21.050	.....
October	5.430	.....	5.280	.....	21.781	.....
November	4.925	.....	4.775	.....	21.438	.....
December	4.254	.....	4.104	.....	20.075	.....
Year	5.962	.....	5.812	.....	23.771	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.